JUNE, 1960

TRAFFIC ENGINEERING

- The Illinois Tollway System
- Traffic Planning for a New Stadium
- Parking Conditions and Habits Near Expressway Interchanges
- Traffic Forecasting for Developing Countries

INSTITUTE OF TRAFFIC ENGINEERS
ITE
FOUNDED 1930

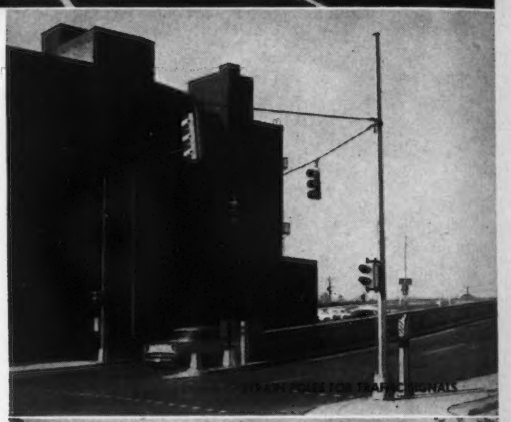
THE CLASSIC—SUPPORTING LANE MARKERS

MAKE YOUR *STANDARD*

KERRIGAN

Maximum strength is combined with beauty of design in all Kerrigan lighting standards, traffic signal supports and sign structures. All over the nation they are now installed on streets, highways and bridges . . . . and in stadiums, parking areas, yards and gardens.

Write today for our new 70-page, looseleaf catalog. It is divided into steel and aluminum sections and contains complete engineering data. Each section is indexed for easy reference. Your copy is free for the asking! Address: Dept. T-6



OVERHEAD SIGN STRUCTURES

TRAFFIC SIGNAL STANDARDS

KERRIGAN
IRON WORKS COMPANY
Nashville, Tennessee

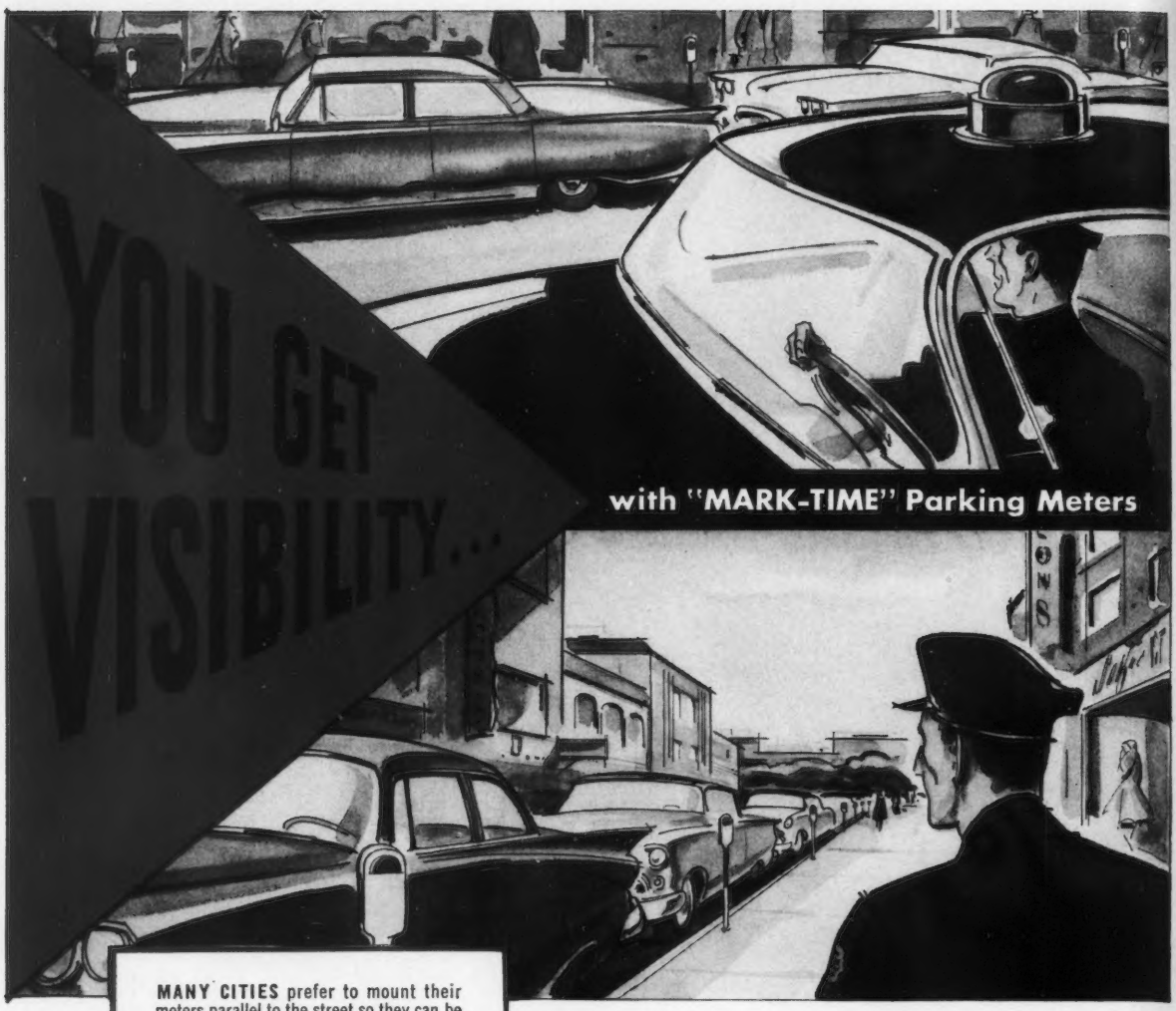
ROCKWELL R STANDARD

Subsidiary of
ROCKWELL—STANDARD
Corporation

STREET AND HIGHWAY LIGHTING STANDARDS

UNIVERSALLY ACCEPTED AS THE MOST DEPENDABLE PARKING CONTROL EQUIPMENT EVER PRODUCED. BACKED BY OVER TWO DECADES OF ENGINEERING EXPERIENCE, TODAY'S "HEAVY-DUTY" DUNCAN-BUILT PRODUCTS OFFER TOP OPERATIONAL EFFICIENCY AT ROCK-BOTTOM MAINTENANCE COSTS PLUS GREAT VANDAL RESISTIVE STRENGTH TO COMBAT THE GROWING PROBLEM OF COSTLY METER VANDALISM. INVESTIGATE THE GENUINE ECONOMY OF DUNCAN'S DEPENDABLE OPERATION. TWO THOUSAND CITIES THROUGHOUT THE WORLD ENJOY THIS ADVANTAGE DAILY . . . WRITE TODAY .

DUNCAN PARKING METER
Division of Motor Products Corporation
835 NO. WOOD STREET • CHICAGO 22, ILLINOIS



MANY CITIES prefer to mount their meters parallel to the street so they can be easily checked from a moving patrol car.

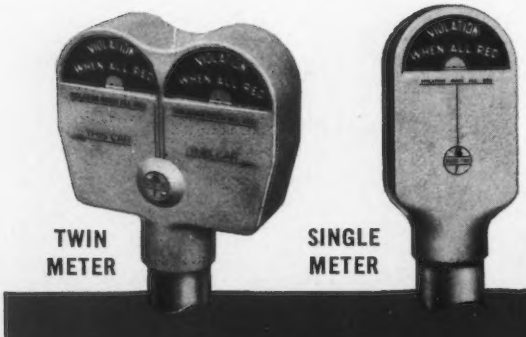
OTHERS PREFER to mount their "Mark-Time" meters at a 45° angle facing the sidewalk. Thus the Patrolman or "Meter Maid" on the beat can easily see the large "Mark-Time" Violation Dial at a glance — from a distance. This method of mounting ABSOLUTELY ELIMINATES "cruising" by motorists looking for unexpired time on meters.

Note the large, easy-to-read Red Violation Dial that can be readily seen at a distance from one side only!

Hundreds of thousands of "Mark-Time" manual parking meters have been purchased by hundreds of municipalities and parking authorities throughout the country—many of whom have re-ordered again and again during the past years. One city, for example, has re-ordered **twenty-eight** times!

"Mark-Time" manual meters eliminate expensive trained clock repairmen on the city payroll! Reduce maintenance costs to a minimum.

We'll be glad to send YOU complete information, or have one of our representatives drop in at your convenience.



Manufactured by

M. H. RHODES, INC.

HARTFORD 6, CONNECTICUT

TRAFFIC ENGINEERING

OFFICIAL PUBLICATION OF THE INSTITUTE OF TRAFFIC ENGINEERS

Vol. 30 JUNE, 1960 No. 9

INSTITUTE OFFICERS

EDWARD G. WETZEL
President

A. F. MALO
Vice-President

GORDON K. GRAVELLE
Vice-President

ROBERT A. BURCH
Secretary-Treasurer

DIRECTORS

EUGENE A. BARTON
District Number 3

M. V. GREER
District Number 5

J. AL HEAD
District Number 6

FRED W. HURD
District Number 1

O. K. NORMANN
District Number 2

EVAN E. OLMSTEAD
District Number 4

MATTHEW C. SIELSKI
Immediate Past President

PUBLICATION STAFF

DAVID M. BALDWIN
Editor

REBEKAH FRIEBELY
Managing Editor

G. A. BACCHUS
J. W. CHAMBLISS
C. C. CLARK
WM. E. CORGILL
R. E. DUNN
M. J. HUBER
E. A. MUELLER
C. C. ROBINSON
S. T. SIEGEL
BURT WHEDON
Associate Editors

CONTENTS

FEATURES

The Illinois Tollway 11
William F. Bauch, Jr.

Traffic Planning for a New Stadium 14
William Marconi

Parking Conditions and Habits Near Expressway Interchanges 18
Michael T. Gruenbaum & Peter Powers Hale

Traffic Forecasting for Developing Countries 22
Salvador M. Padilla-Escabi

NEWS

Traffic News 27
Strictly Business 35
New Publications 41
Coming Events 50

TECHNICAL NOTES

Use of Non-Recording Traffic Counters 43
Use of Plywood for Highway Signs 46
An Inexpensive Wire Reel Carrier 49
Electronic Computers for Parking, Traffic and Transit Surveys 49

INSTITUTE AFFAIRS

Yearbook Changes 54
Membership Applications 55
Section News 56

MISCELLANEOUS

Positions Available 43
Sustaining Organizations 56
Index to Advertisers 58
Professional Service Directory ..... 58 & 59

Cover: Detroit's Cobo Hall—An aerial view of the largest exhibition hall in the world. In the left foreground the John C. Lodge Expressway runs beneath the building. In the upper corner appears the spiral ramp by which vehicles reach parking space on the roof for 1200 cars. In adjacent areas there is space for an added 1440 vehicles.
—Photo from Detroit Department Report and Information Committee

TRAFFIC ENGINEERING is published monthly by the Institute of Traffic Engineers. Editorial offices are at 2029 K Street NW, Washington 6, D.C. Advertising plates should be sent to Interstate Printing Corp., 400 Watchung Avenue, Plainfield, N. J. Advertising representatives: New York—Seymour A. Robbins & Associates, 489 Fifth Avenue, N. Y. 17. Chicago—Scott Kingwill & Associates, 35 E. Wacker Drive, Chicago 1. Los Angeles—Jess M. Laughlin Co., 711 South Vermont Ave., Los Angeles 5. Printed in U.S.A. Second class postage paid at Plainfield, New Jersey. ¶Single copies 50 cents, subscription price $4.50 per year in the United States and Canada; $5.75 per year to foreign countries.

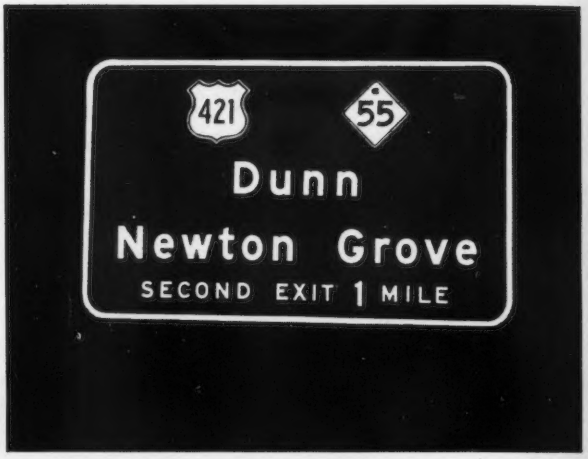
The Institute is not responsible for any statements made or opinions expressed in its publications. Publication of advertising does not constitute Institute approval or endorsement of the products or services advertised. Permission to reprint contents with customary credit line is given unless otherwise stated. The Institute seal, pictured at the upper left on this page, is a Registered Trade Mark of the Institute of Traffic Engineers.

3M COMPANY
Reflective Products

signing
NEWS AND VIEWS

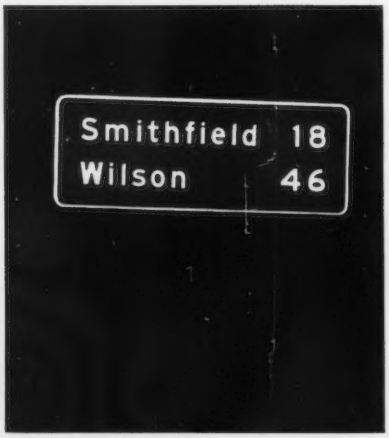
From the makers of "Scotchlite" Brand Reflective Sheeting, "Codit" Brand Reflective Liquid and other reflective products for modern traffic control and safety

GREEN IS GREEN DAY AND NIGHT ON N. CAROLINA'S INTERSTATE 95



CONSISTENT COLOR. Guide signs on North Carolina's Interstate 95 are always brilliant green—never appear dead black at night. That's because the backgrounds are reflectorized with vivid, all-weather "Scotchlite" Reflective Sheeting. And the basic elements of efficient signing—color, shape, and legend—are truly uniform, always look the same. For complete information on full-time sign performance, ask your 3M Representative or write: Reflective Products Division, Dept. RBI-60, 3M Co., St. Paul 6, Minn.

GOOD SIGNING is traditional in North Carolina—and as carefully engineered as the state's good roads.

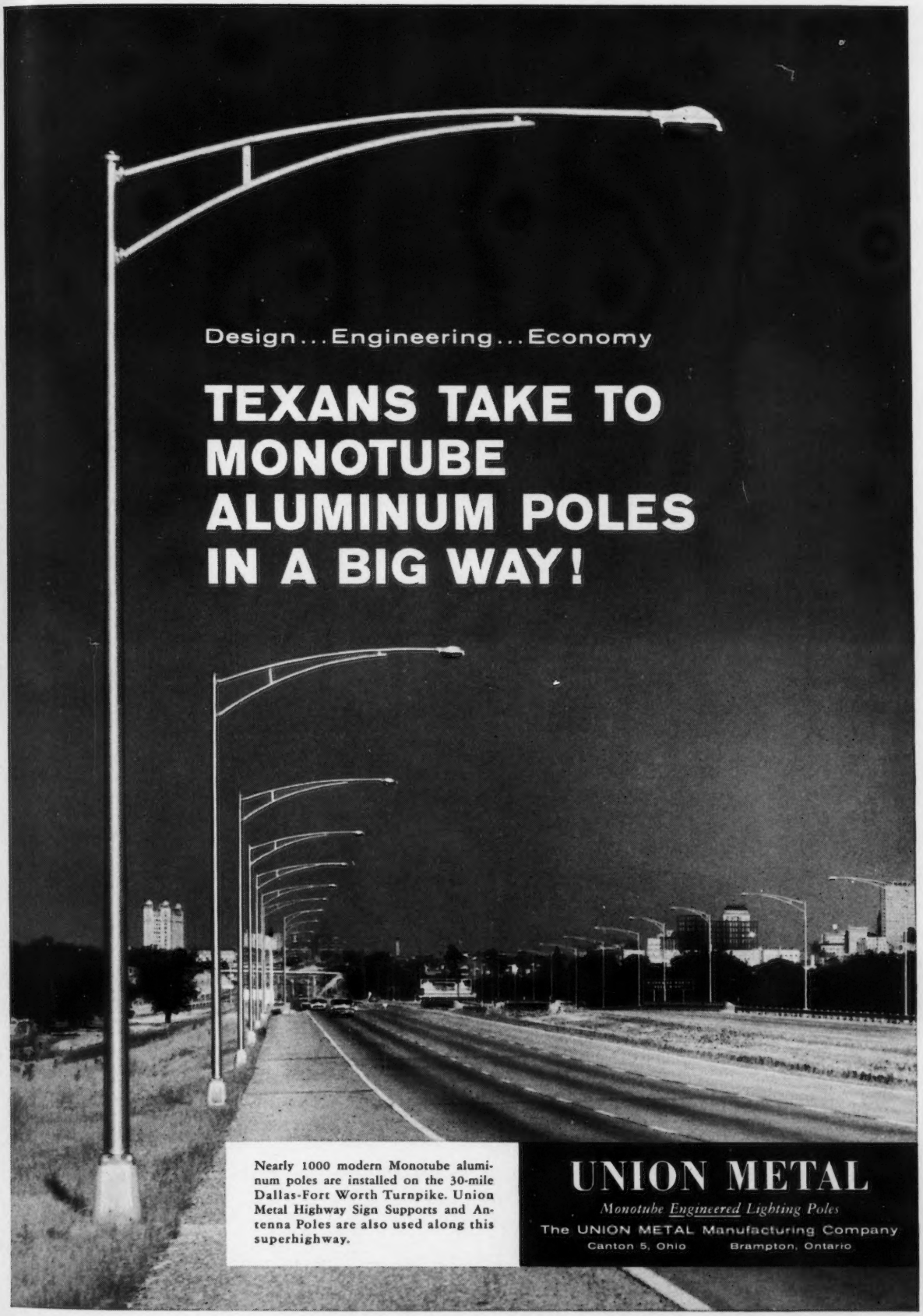


REFLECTIVE COLOR identifies signs at long range, alerts motorists to prompt, safe action night and day.

COLORIMETER at 3M checks samples of "Scotchlite" Sheeting against color standard, assures uniformity.

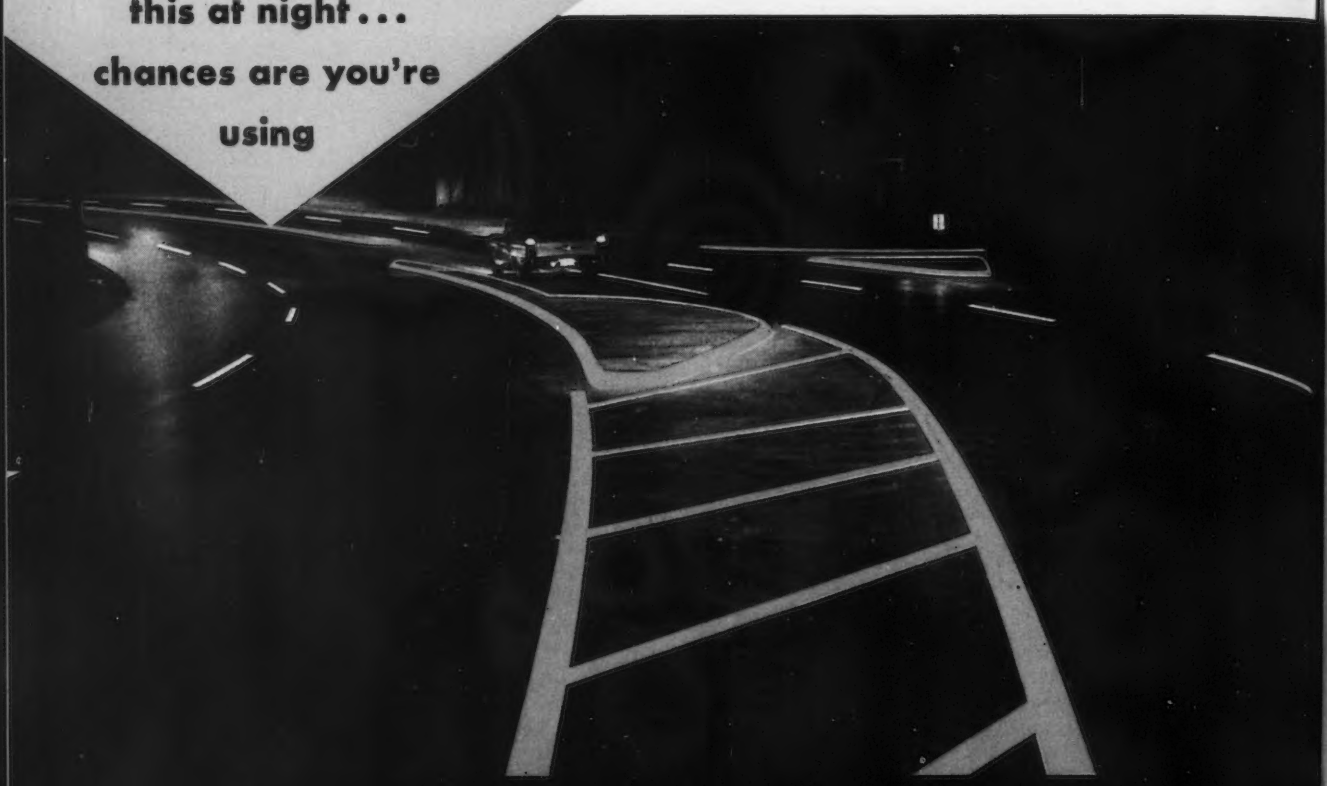
MINNESOTA MINING AND MANUFACTURING COMPANY
. . . WHERE RESEARCH IS THE KEY TO TOMORROW

The terms "Scotchlite" and "Codit" are registered trademarks of the 3M Company


Design...Engineering...Economy
TEXANS TAKE TO MONOTUBE ALUMINUM POLES IN A BIG WAY!
Nearly 1000 modern Monotube aluminum poles are installed on the 30-mile Dallas-Fort Worth Turnpike. Union Metal Highway Sign Supports and Antenna Poles are also used along this superhighway.
UNION METAL
Monotube Engineered Lighting Poles
The UNION METAL Manufacturing Company
Canton 5, Ohio
Brampton, Ontario

If your pavement markings look like this during the day...

and still look like this at night... chances are you're using



CATAPHOTE *reflective traffic beads*

Clean bright stripes in daylight . . . brilliance that fairly leaps from the darkness at night . . . here are pavement markings that work full-time. In fair weather or foul . . . you can depend on life-saving protection when you reflectorize with Cataphote Waterproof Reflective Traffic Beads.

Cataphote Beads are easy to use. They may be premixed in traffic paint and applied with any conventional striping equipment. For immediate reflectance, use Cataphote Drop-on Beads in any standard bead dispenser. Regardless of method, you'll be rewarded with increased safety, faster paint drying time and 50% longer "stripe life."

Men who set the trends in traffic control have used Cataphote Reflective Beads for years. Catalog B-160 can help you be a leader, too. Send for it, today.

CATAPHOTE CORPORATION

TOLEDO 10, OHIO / JACKSON, MISSISSIPPI

MANUFACTURERS OF REFLECTIVE TRAFFIC PRODUCTS

Frankly Speaking . . .

WHAT CAN BE EXPECTED in the 1960's as far as the various elements of highway design are concerned?

Ellis Armstrong (U.S. Commissioner of Public Roads) answers the question with the following: "The 99 million vehicles of 1970 will be operating on a highway network essentially of the same extent as we now have—some 3.4 million miles of roads and streets . . . The crying need, which we hope to accomplish to fairly extensive measure by 1970 is not more miles, but better ones. . . .

"One of the great research projects of all times — the American Association of State Highway Officials road test in Illinois—will be history in 1970. We expect it to be historic indeed. The literally millons of statistics, measurings, and samplings collected will be grist for research analysts and engineers in the attack on problems of structural design, and we can look not only to practical, empirical solutions of design problems, but, even more importantly, ultimately to the development of rational scientific theories of pavement design, based solidly on fact, which in turn will lead to better, more economical pavements.

"It is not probable that there will be changes of great magnitude in geometric design by 1970, either. The basic principles and the criteria are fairly well crystalized, and what we can anticipate is a continuing refinement in application. The basic pattern of the expressway is already found in the Interstate System Standards. Extensive studies of the driver-vehicle-road relationships have already taught us much that is now incorporated in highway design, but we know there is much yet to be learned. Research in the next ten years will undoubtedly provide us with measures and guides for design improvement.

"An area in design technology where great concentration of effort is needed and will surely come during the next decade is the spot improvement of primary and secondary rural roads through the scientific location of bottlenecks and the economic weighing of solutions of best advantage. The methodology for this approach has been devised and tested, and we can look for its widespread employment.

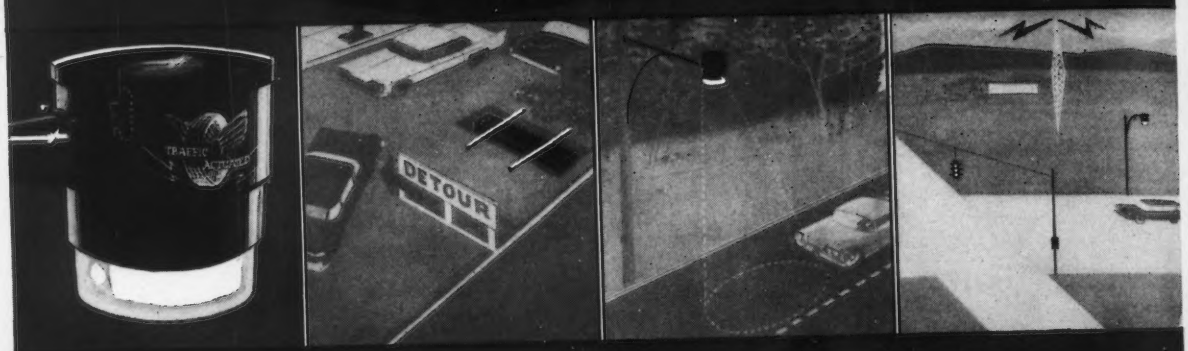
"A similar approach is now under study for application in urban areas where the problem is most acute. We cannot afford to make every traffic corridor a superhighway, but we can do a great deal toward making modified expressways out of the city thoroughfares, and by 1970 this undoubtedly will become an established and common practice. Careful timing and use of traffic signals, adjustment or elimination of curb parking, special transit loading bays, street widening where necessary, control of access in critical locations, and even grade separations at bottlenecks will be used to alleviate congestion and provide uniform, enlarged traffic capacity. None of these remedies is individually novel. What is new now, but will probably be common in 1970, is the scientific and comprehensive examination of the problem as a whole and the development and application of a balanced solution.

"Technical developments in electronic systems for supplying information and guidance to the driver and even control of a vehicle may be expected to multiply in variety and capability in the coming decade. Sensing equipment, providing an immediate and effective adjustment of traffic signals to meet the constantly changing patterns of traffic, will undoubtedly be in operation by 1970 in a number of our larger cities. Television monitoring of urban expressway traffic, to alert both the authorities and motorists of traffic jams or accidents, will probably be used in some locations. Possibly some of the radio transmitter-car receiver warning and information devices will have been installed for extensive trial operations. It seems unlikely, however, that the more complex guidance and control electronic equipment will have evolved by 1970 beyond the proven experimental stage. The cost of installation to the highway agencies and to the individual owners, the legislation needed for legal authority to require that vehicles be equipped with the necessary devices, and the question of responsibility of highway authorities in case of communications breakdowns, are staggering problems that will eventually have to be faced. Ten years seems too short a time for their accomplishment, but the economic and legal aspects will probably have begun to be explored...

"If there is a single word that signifies what we are striving for and hope to obtain to a generous extent by 1970, that word is capacity. Adequate capacity in essence means satisfactory provision for vehicle movement, between origins and destinations of the driver's choice, with economy of time and operating costs, a minimum of friction in driver tension and fatigue, and a maximum of comfort and enjoyment."

Quoted in SAFETY IN THE SIXTIES, *published by the National Safety Council*

here are 8 reasons why the ELECTRO-MATIC® RADAR VEHICLE DETECTOR solves more traffic signal problems:



1.

2.

3.

4.

5.

6.

7.

8.

EASTERN INDUSTRIES, INC. • NORWALK, CONNECTICUT

The Illinois Tollway

By William F. Bauch, Jr.
Traffic Engineer
Illinois State Toll Highway Commission

THE 187-MILE ILLINOIS TOLLWAY—the largest public works project in the history of the State of Illinois— speeds traffic through the congested Northern Illinois area. It consists of three integrated routes, the Tri-State Tollway, Northwest Tollway, and East-West Tollway.

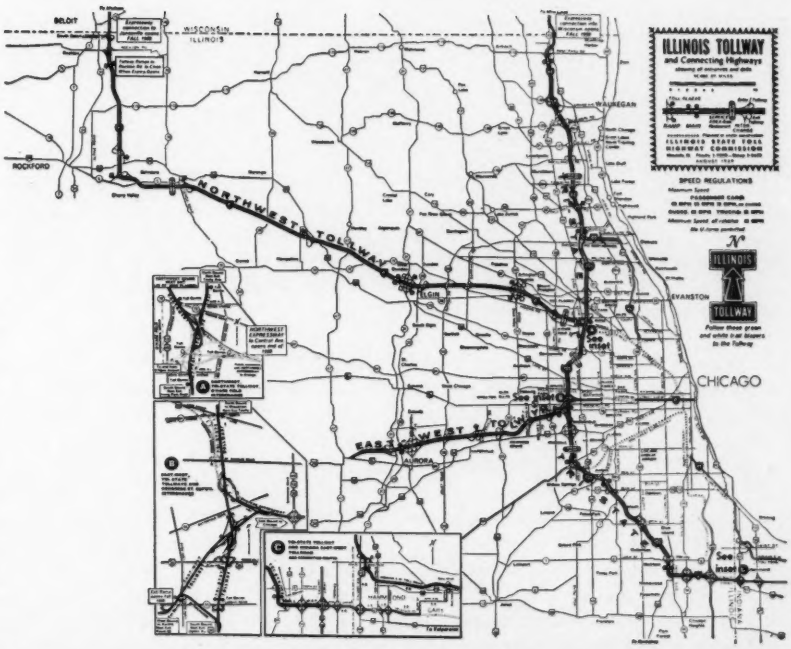
The Tri-State Tollway is a belt route around Chicago from Indiana to Wisconsin. On the south it connects directly with Kingery Expressway leading from Indiana, and on the north with Interstate Route 94, a 25-mile expressway extending almost to Milwaukee.

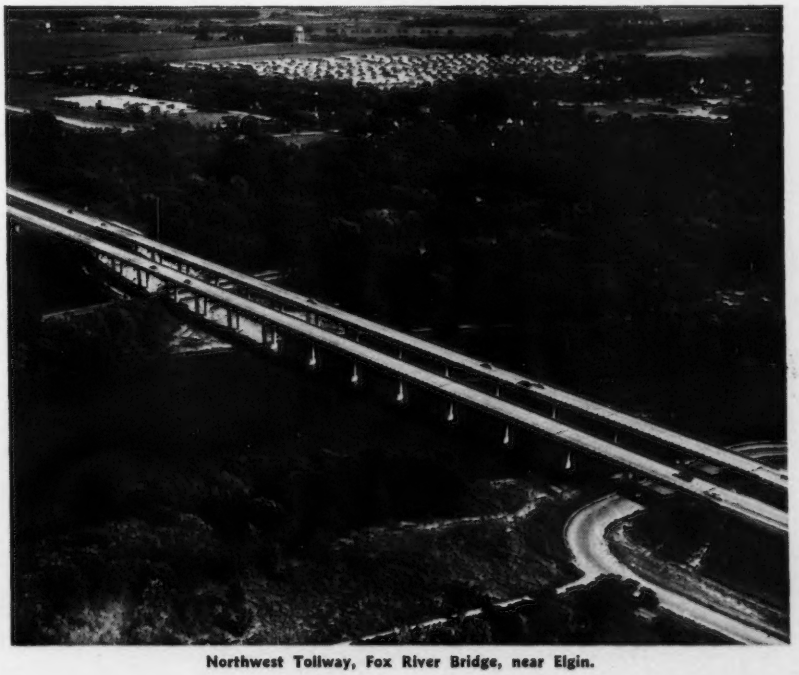
The Northwest Tollway extends from a direct connection with Chicago's Northwest Expressway east of O'Hare Field to a direct connection with Interstate Route 90 near South Beloit. The Northwest Tollway passes near Elgin, Belvidere, and Rockford to South Beloit.

The East-West Tollway extends from a direct connection with the Congress Street Expressway in Hillside to a connection with U. S. 30 west of Aurora for traffic to the Quad-Cities and Iowa.

The Illinois Tollway was financed by the sale of revenue bonds to private investors in the total amount of $441,279,000. Construction of the tollway started in September, 1956. The 76-mile Northwest Tollway was opened to traffic in August, 1958, and the entire system was in operation in December, 1958, ahead of schedule. Approximately 130 miles of the 187 miles have been designed as part of the Interstate System and are so marked.

In the 27 months that elapsed between the beginning of construction and the opening of the entire 187 miles to traffic, tremendous amounts of manpower, equipment and materials were devoted to the task of meeting the intensive time schedules that were necessary. The Tollway grading contractors were required to move 74,400,000 cubic yards of earth. More than 2½ million



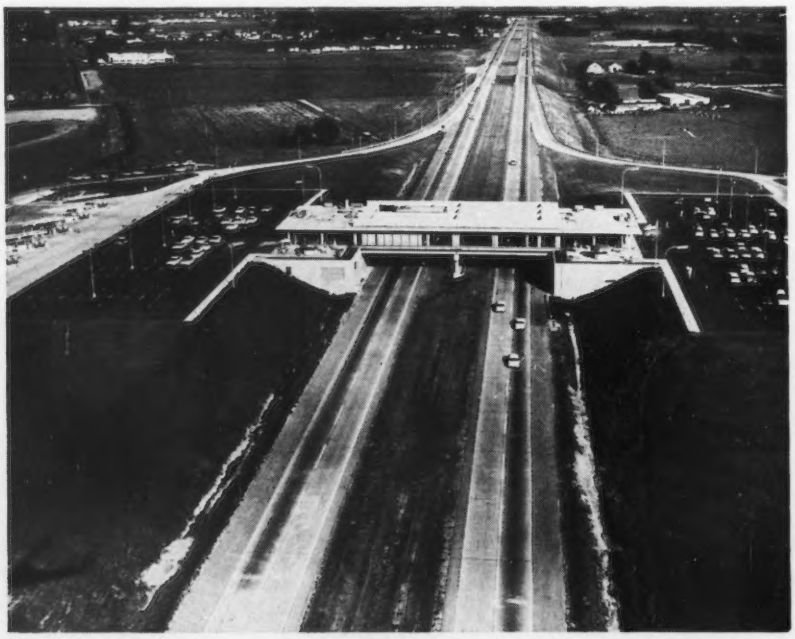


Northwest Tollway, Fox River Bridge, near Elgin.

Tri-level interchange of the Northwest and Tri-State Tollways, near O'Hare Airport.

cubic yards of reinforced concrete were used in constructing the Tollway pavements. There are 265 bridges on the Tollway, 42 of which are crossings of 15 different railroads. Of the 265 bridges, 219 use prestressed concrete girders, 49 use structural steel girders and 3 are a combination of prestressed concrete and structural steel girders. Six of the structures exceed ¼ mile in length with the longest being 0.9 mile long. At 1,100 locations existing utility facilities had to be removed, relocated or reconstructed. The right of way for the 187 miles cost approximately $56,000,000 for some 6,500 parcels, none of which could be acquired using "quick take" procedures.

In addition to the highway facilities, the public and commission staff are served by several buildings of various sizes. An administration building and a central shop building provide the control headquarters for the commission. For operating purposes the Tollway is divided into eight sections, each of which has a headquarters for maintenance personnel and equipment. In five of the sections toll collection facilities are built jointly with the maintenance building. In addition, there are fifteen locations at which buildings and plazas are used exclusively for toll collection. The public is served with rest, food and vehicle service facilities at five oases distinguished by very attractive over-the-road restaurants.



Des Plaines Oasis.

The signs for the 50 interchanges and five service areas were fabricated and erected under a contract approximating $956,000. All interchanges, toll plazas and service areas are illuminated. Approximately 3,800 mercury vapor lights are installed at the interchanges and service area acceleration and deceleration lanes. The parking areas in the vicinity of the restaurant buildings are illuminated by approximately 185 fluorescent units. Almost 21,000 delineators have been installed on both sides of each roadway. Two hundred foot spacings have been used on tangent sections with shorter spacings on the outside edge of curves.

The Illinois Tollway has been designed and constructed to accommodate two distinct types of toll collection systems. The fifty mile section of the Tollway lying west of the Fox River—which extends from Elgin, Illinois, to the Wisconsin state line near Beloit—contains the conventional ticket or "closed" system of toll collection. The section contains four trumpet type interchanges between the main line plazas at each end. At the entrance plaza each patron is given a ticket which he carries with him and surrenders with his fare at the exit plaza.

The remaining 137 mile section contains the "open" type toll collection which consists essentially of main line barrier plazas placed strategically with respect to interchanges so as to obtain maximum revenue consistent with good traffic service to the areas served by the Tollway. A fare is paid at each toll plaza, where toll collectors or automatic toll collection machines are available. There are nine main line plazas and two ramp barriers. In addition, honor system automatic toll collection machines have been installed on twelve ramps at four interchanges. In all there are 157 lanes equipped with toll collection equipment.

The year 1959 was the first full calendar year of operation of the Illinois

Tollway. Therefore, the end of 1959 presented the first opportunity to develop annual operating data relative to traffic volumes, trip length and revenues per vehicle. Three sources of data were used in developing the data.

1. A daily report of traffic volumes passing thruogh each toll plaza.

2. Ramp volume counts derived from a program of weekly counts on each ramp.

3. The total and average daily revenue for 1959.

The portion of the system containing the closed system of toll collection presented no problem since the toll ticket given to each patron provided a complete origin-destination for each tollway trip every day. The comparable data for the portion of the Tollway containing the open system of toll collection was obtained by first reducing all ramp and toll plaza counts to average daily traffic. The summation of all vehicles entering the Tollway on the "average day" equalled 62,321. These vehicles paid average daily revenue of $39,639.16, or an average of $0.64 per vehicle.

A traffic flow map for the entire tollway was prepared and vehicle mileage on the open system was calculated using ramp and plaza average daily volumes together with the exact distance between interchanges. The vehicular mileage on the open system was added to that from the closed system and it was found that the 62,321 drivers on the "average" day drove 1,753,465 vehicle miles, for an average trip length of 28.14 miles.

During the "average day" in 1959, 117,637 separate toll transactions took place throughout the system. Therefore, each driver participated in 1.89 transactions while making his 28.14 mile average length trip. It is noteworthy to recall that a pre-construction objection to the open system was the alleged greater number of stops required of a driver when compared to the closed system roads. However, the 1959 operating data shows the Illinois Tollway users to be inconvenienced not at all by the barrier system when the 1.89 transactions per vehicle are considered.

Also during 1959 it was determined that each vehicle produced revenue amounting to 2.27 cents per vehicle mile driven. This is a very convenient figure to use in making various rule-of-thumb calculations relative to monthly mileages, accident rates and the like, since revenue figures are readily available within a day or two after the end of each month.

Deerfield Road Toll Plaza on Tri-State Tollway.

A remarkable safety record was established on the Illinois Tollway in 1959. During the year 600 reportable accidents occurred with the following severity:

a) 3 fatal accidents in which 3 people were killed; 173 personal injury accidents in which 262 persons were injured; 424 property damage accidents.

During 1959, all vehicles on the tollway were driven a total of 640,014,000 miles. This accumulation of vehicle miles permits the calculation of the following rates:

a) Fatalities—0.46 fatalities per 100 million vehicle miles;

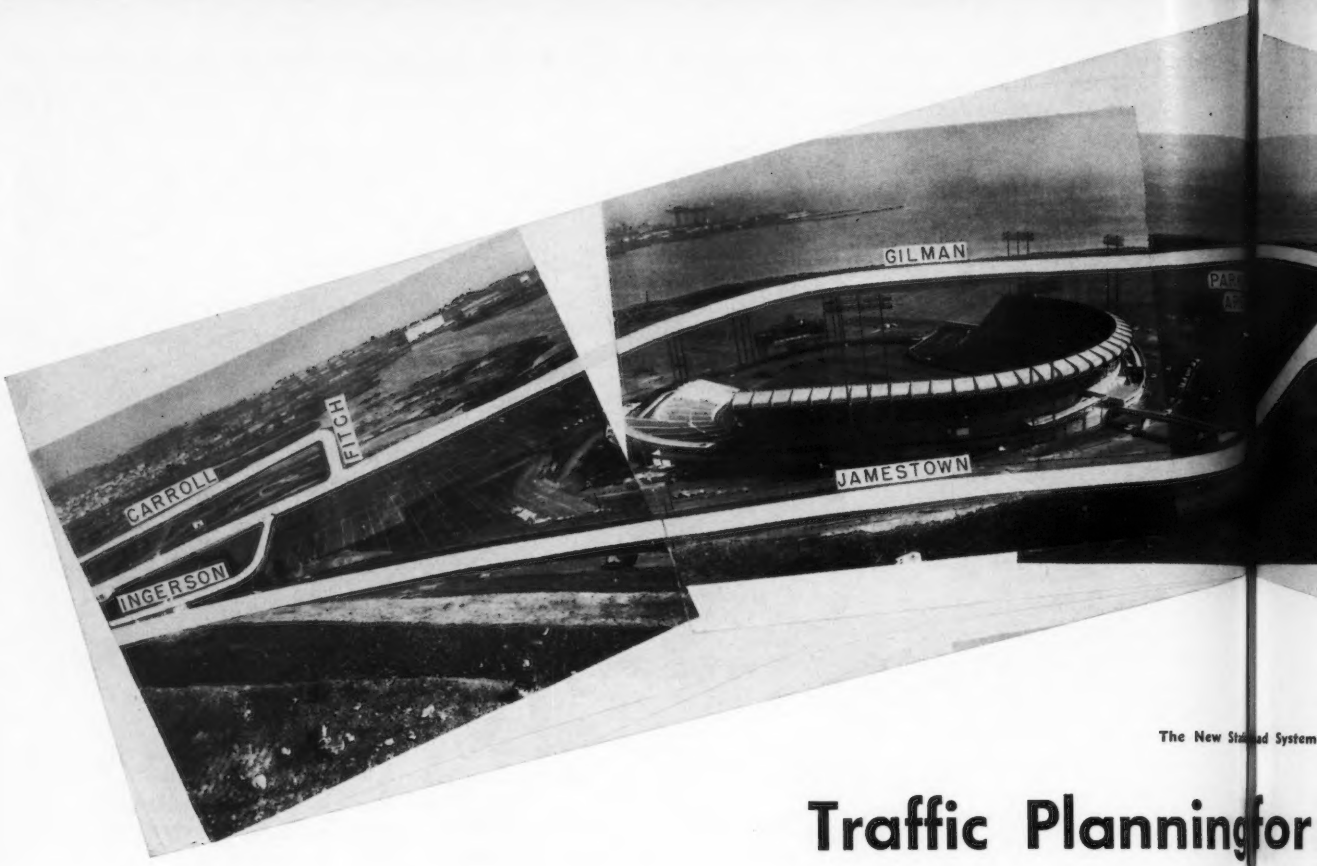
b) Personal injuries—40.0 injuries per 100 million vehicle miles;

c) Accidents—93.7 accidents per 100 million vehicle miles.

The annual summary of motor ve-

(Continued on page 43)

Illinois Tollway. Administration Building and Central Shop on East-West Tollway.



The New Sta[illegible]ad System

Traffic Planning for

By William Marc[illegible]ssistant

THE NEW $11,000,000 STADIUM for the San Francisco Giants is now nearing completion after a construction period of 26 months. Built on filled-in tidelands in San Francisco Bay, it required the development of a $4,500,000 road and sewer system to serve it and afforded the opportunity for the installation of many traffic engineering techniques new to San Francisco to implement the operation of the system.

Background

Following the successful move of the Boston Braves to Milwaukee, it appeared likely that other major league baseball teams experiencing attendance difficulties were ripe for a move to the lush green pastures provided by the burgeoning population of the West Coast. As a result, a proposition was set before the voters of the City of San Francisco and subsequently approved which provided a bond issue for the construction of a baseball park if and when a major league team decided to relocate here.

In August 1957, the New York Giants, together with the Brooklyn Dodgers decided to take heed of Horace Greeley's maxim and move to San Francisco and Los Angeles, respectively. The only baseball park available in San Francisco was Seals Stadium, a fine minor league ball park which suffered, however, from two limitations: a 22,000 seating capacity and a lack of off-street parking in the immediate vicinity. As a result, it was decided that while the stadium could be used for an interim period, a final home for the Giants would require a complete new stadium together with adequate off-street parking.

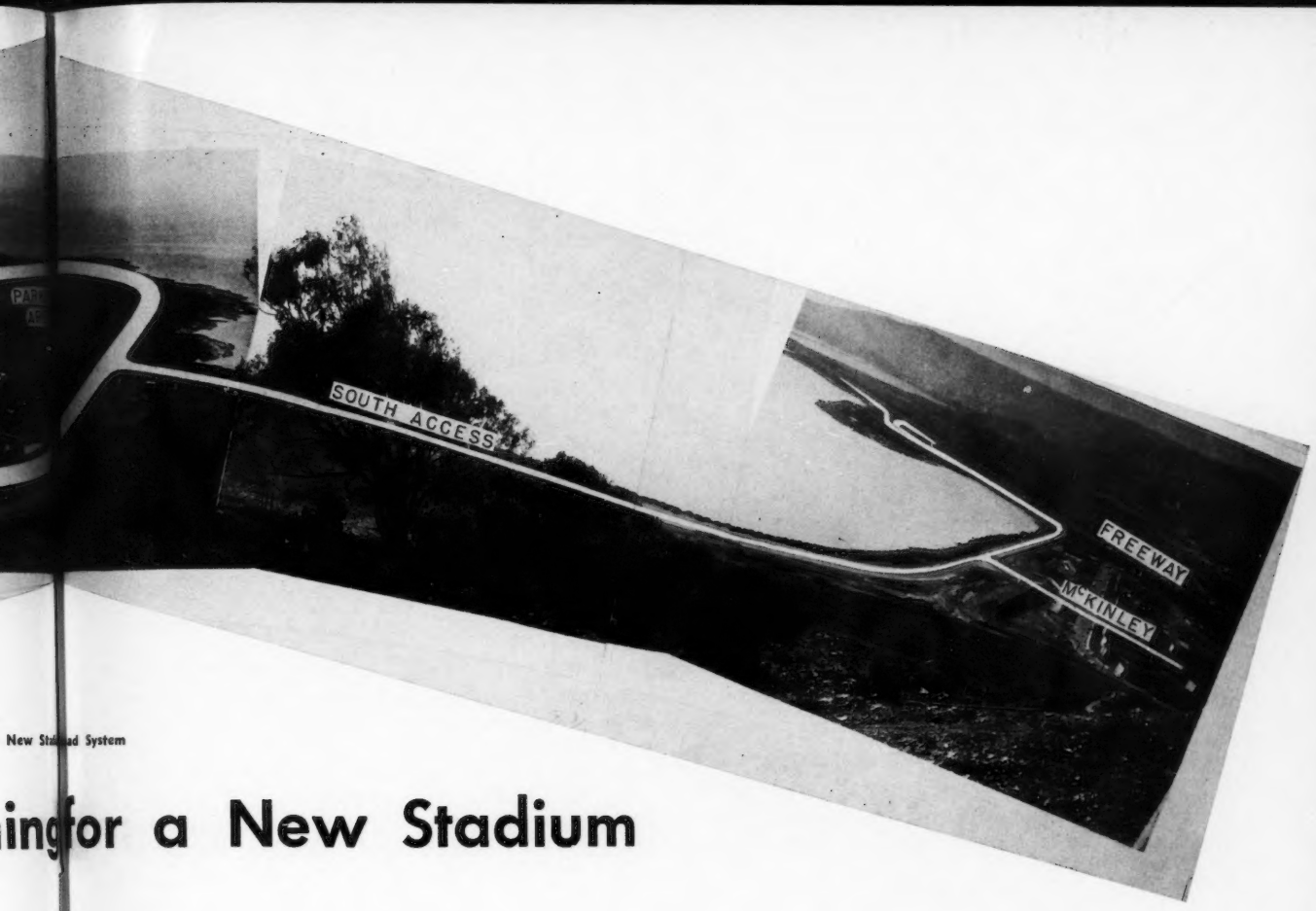
Stadium Site

Since San Francisco has only 48 square miles and is almost completely developed, the sites available were few in number. The location finally chosen was a tidelands area in the southeast corner of the city which, like the Florida lots of a generation ago, was mostly under water. It is directly north and east of a hilly peninsula called Candlestick Point from which the park eventually drew its name.

A 45,000 capacity stadium, together with parking space for 8,000 vehicles, was decided upon. Since no streets were developed, it became the problem of the San Francisco Department of Public Works to develop and operate a road system which would adequately handle traffic generated by the ball park.

Major Existing Routes

The stadium location is shown on the accompanying plates STR-2844 and STR-2799, together with the major traffic arteries serving the area. There are three existing



New Stadium System

ing for a New Stadium

Marc[illegible] Assistant Traffic Engineer, San Francisco, Calif.

trafficways to the north, including one freeway and two high capacity arterial streets, two to the south, including a freeway and an arterial street, and one arterial street to the west. These roadways, while having high capacity, unfortunately are heavily loaded with traffic volumes ranging between 15,000 and 140,000 vehicles per day.

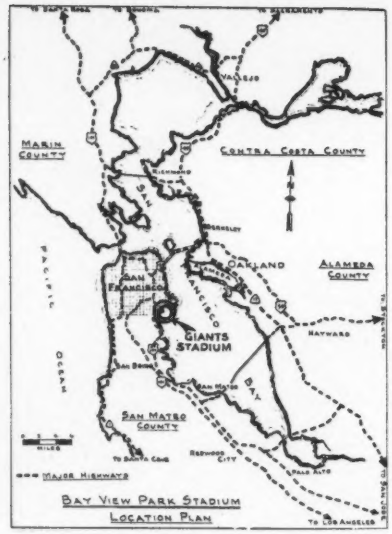
However, as can be seen from the topography, motorists exiting from the stadium would have to use these routes. The main problem in regard to the design of the new roadway system was to devise a street layout which would connect into these trafficways.

Origins and Destination of Stadium Traffic

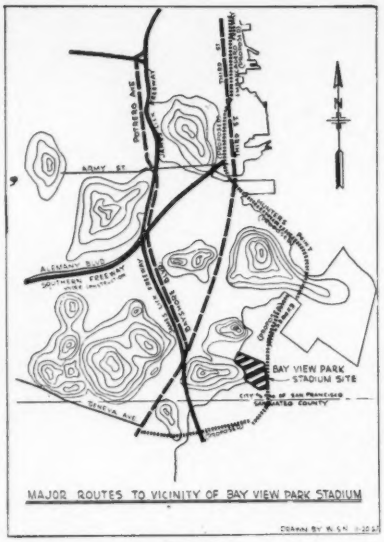
To properly design connecting roads to the major traffic arteries, it was necessary to know where traffic was coming from and going to. Since at that time the Giants had yet to play their first game in San Francisco, it was necessary to make certain assumptions as to source of their patronage. The peak vehicle volume to be handled was assumed to be equal to the capacity of the parking lot plus as many buses and taxis as would be required to fill the part of the stadium not used by motorists arriving in automobiles. The patronage at the stadium was assumed to be directly proportional to the populations of the population segments within a 100-mile radius and inversely proportional to the distance between the centers of these populations and the stadium. The results of this analysis shown on the accompanying Plate STR-2795 indicated that approximately 59% of the patronage would come from within San Francisco, 25% from the East Bay, 3% from Marin County and the north, and 13% from the San Francisco Peninsula and the south.

Road System and Predicted Traffic Volumes

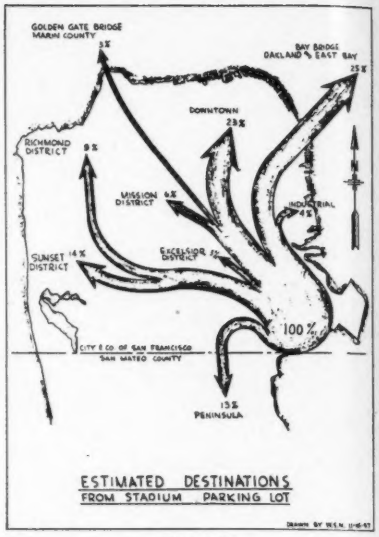
To an extent, the road system to be developed was partially fixed by an existing street system a quarter of a mile west of the stadium. All the roads leading from the stadium had to tie in to this street network except for an entirely new roadway leading from the James Lick Freeway and Candlestick Road. In designing the new road system, it was assumed that peak traffic volumes from a capacity crowd exiting from the stadium would on occasion coincide with the evening peak hour traffic on the major traffic ways. This was the critical criterion since pregame stadium bound traffic would most likely never coincide with a peak period of demand for normal traffic. The predicted exiting traffic volumes generated by the stadium are shown superimposed on the peak hour traffic loads on the normal trafficways on the accompanying Plate STR-2846, Ch. 1. The roadway system attempts to distribute



STR-2844



STR-2799



STR-2795

the stadium traffic to a number of points in order to reduce traffic congestion and also to reduce crossing conflicts wherever possible.

Operational Techniques

Because of the short periods of highly directional peak demand of traffic generated by the ball park, it was decided early in the program to adopt traffic techniques particularly adaptable to handling such movements. Some of these used are as follows:

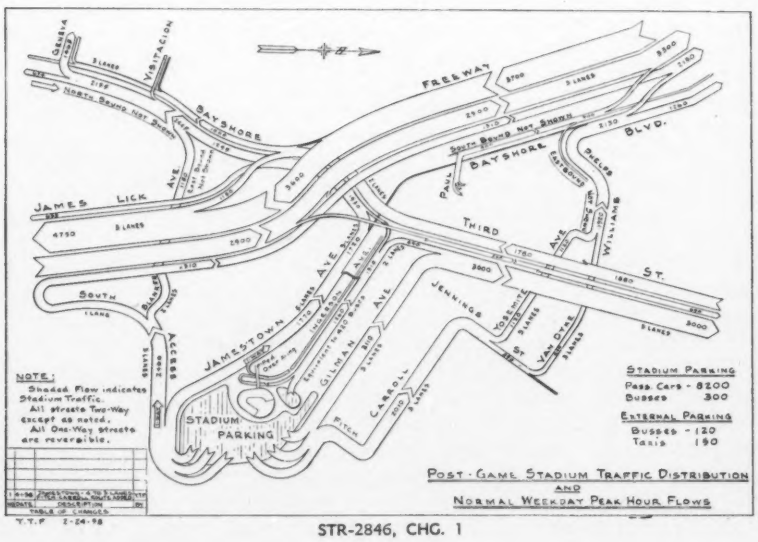
1. Reversible one-way streets.
2. Reversible lanes.
3. No stopping during pre- and post-game periods.
4. Streets reserved for buses and taxis.
5. Streets reserved for autos.

Particular care was taken to avoid the need for a significant volume of pedestrian traffic to cross a major vehicular flow. The reversible one-way streets with reversible lanes and streets restricted to buses and taxis are shown on the accompanying Drawings STR-2835 and STR-2835.1.

Signs and Markings

To effectuate the traffic plan determined upon, it was necessary to design and install a complete system of signs, and pavement markings, to designate the operation to the motorists. While police would be available to direct traffic, as much as possible was planned to be done by means of signs and markings to implement the plan in order to reduce the amount of police personnel needed to keep it working. Figure 1 shows the type of No Stopping sign used at this location. The design is a modification of our standard No Stopping sign and is designed to catch the eye of the motorist. Cardboard inserts covering two months of playing dates are placed on the bottom of the sign between special clamps to indicate on what days towaway is effective.

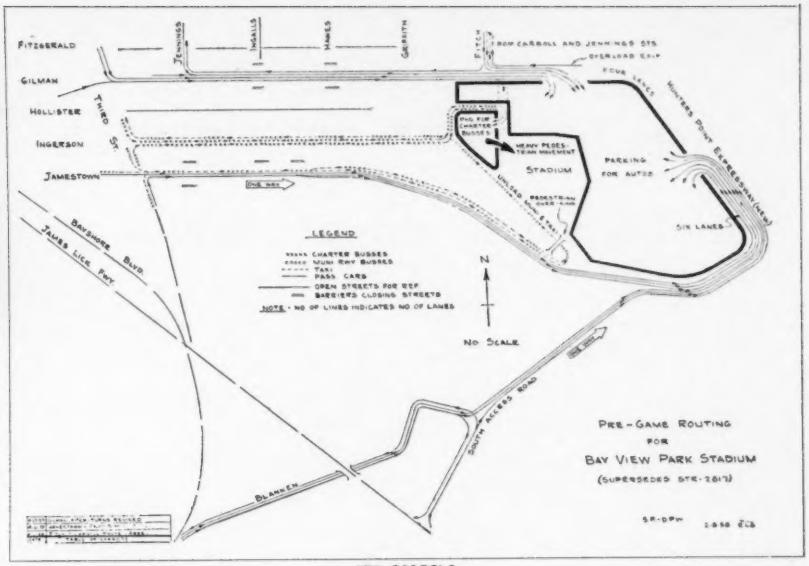
Figure 2 shows the reversible one-way street signs. It does not have the effective days of the regulation posted, but it is felt that the flow of traffic itself will be adequate to enforce the regulation. Signs shown on Figure 3 are used on streets with reversible lanes. Generally speaking,



STR-2846, CHG. 1

Figure 1

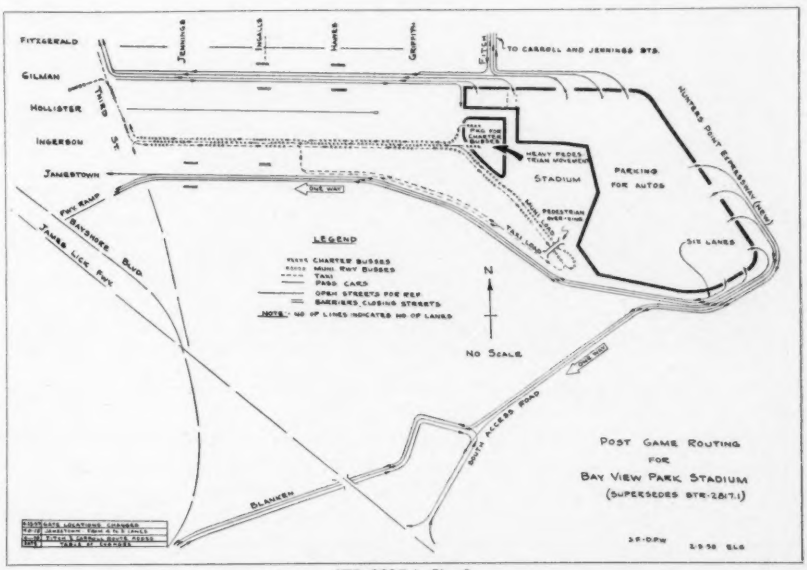
Figure 2



STR-2835Ch3

the program aims to keep two to three traffic lanes flowing in the major direction and a single lane flowing in the minor direction. The instructions on the signs read, for example, "Pre-Game Curb Lane Only." This sign faces motorists going away from the stadium. It would inform the motorist that he could use only the curb lane. The sign facing the other direction would read "Pre-Game Keep Out of Left Lane." A motorist going to the stadium would be informed that he could use any lane except the extreme left lane for his travel.

An example of the types of pavement markings used are shown in the accompanying Figure 4. The solid center line is the pavement marking used by motorists on no-game days when parking is allowed on the street. On ball game days, this street is a reversible one-way street striped for three lanes and the dash markings are used to indicate lane markings.



STR-2835.1 Ch. 3

Figure 3

Figure 4

Parking Conditions and Habits Near Expressway Interchanges

By Michael T. Gruenbaum,
Research Associate, Yale University
Bureau of Highway Traffic
and
Peter Powers Hale,
Vice President, Technical Planning Associates,
New Haven, Connecticut

Figure 1
A typical example of all-day parking under an overpass—Stamford, Conn.

IN EXPRESSWAY DESIGNS up to the present time, no provisions for parking have been made in the vicinity of the most convenient meeting place: the interchange. However, there is a growing need to remedy this situation along existing throughways and to incorporate such facilities into original designs. In Connecticut a trend has been observed where the interchange is used as a meeting place for people working in the same office, plant or area, but living in different cities or different sections of the same city. These people form pools and each group continues from the interchange station to its place of work in only one car, instead of three or four. During a study of eleven interchanges conducted in the winter of 1957 on the Merritt Parkway between New Haven and Stamford, the "left-over" cars were found parked on ramp shoulders and adjacent landscaped areas, on and under bridges, on shoulders of secondary roads wherever shoulders were available, and where there were none, on the roadway itself. (Figures 1-4.) Such parking can be attributed to an absence of restrictions in these locations and the widespread practice of it is a good indication of the high degree of the commuters' needs and desires rather than any encouragement by the local authorities. However, this manner of parking has resulted in reduced road capacities, affects sight distances, breaks up shoulder pavement and destroys landscaping. In addition, accident hazards have increased because of the way cars are parked (for example, on curves) and because surface friction has been reduced by mud and wet leaves carried on to the pavement as the cars are removed from the shoulders. Therefore, focusing attention on this growing trend and the habits of the people involved became the primary objective of this study. This entailed gathering information concerning the parkers, such as their origins and destinations, the duration of their parking, the total demand at each interchange as well as other pertinent characteristics; these were studied from data obtained by direct interviews, mail surveys, and periodic volume counts of parked cars.

NOTE: This report is partially based on data gathered by Mr. Gruenbaum for his student thesis at Yale during the academic year 1958-59.

Study Procedures

Direct interviews were held only at three interchanges along the Merritt Parkway, those on the outskirts of New Haven. These locations were selected because substantial parking had been noticed there and because they were easily accessible from New Haven headquarters. Parkers were interviewed as they arrived between 6:30 A.M. and 8:30 A.M. and since most of them had to wait for their companions, they had enough time to answer the questions of the interviewer. License plates of both the parked car and the one in which the parker was picked up were recorded for future reference and check.

The mail survey, conducted at all eleven interchanges, consisted of a questionnaire and a stamped self-addressed envelope which were left on the windshields of the parked cars. The date, the time of day, the location and the license number of each car were recorded on each form by the investigator himself, while at the same time he noted the license numbers in his own records. This procedure was adopted for checking purposes as well as to exert some psychological pressure on the parkers to return the forms. After waiting for a reasonable time to elapse for all of the forms to be returned by mail, a second distribution of forms was undertaken in order to

get information on any of the parkers who had not been there the first time and to cover again those car owners who had not answered the first survey. The three interchanges covered by the direct interviews were also revisited and forms were left on cars whose drivers had not been contacted during the interviews. Altogether, 317 of such forms were distributed at the eleven interchanges under study; 150 were sent in which made for a 47.3% return. Summaries of all answers to each question on the form then were made, but only one answer per parked car was included. For example, in a car pool of two men where each car was used alternately, we might have found one car parked during the first survey and the other during the second survey. If both car-owners returned the forms, it was evident from the answers that they belonged to the same pool and thus only one answer was used in the summaries.

TABLE 1

Three Sample Volume Counts of Parkers
at Various Interchanges on the Merritt Parkway, Connecticut

Interchange	Volume Counts 1	2	3	Average	Total per community (average day)
New Haven					
Whitney Ave.	19	16	16	17	
Dixwell Ave.	8.5*	7	10	8.5	
Whalley Ave.	38	40	36	38	
Derby Ave.	17	18	21	18.7	82.2
Bridgeport					
Route 8	44	39	42	41.7	
Route 113	11	14	10	11.7	
Route 58	30	32	33	31.7	85.1
Westport					
Route 57	7	7	13	9	9
Darien					
Route 29	2	2	2	2	2
Stamford					
Route 137	7	9	16	10.7	16
Route 104	7	4	5	5.3	16
Totals	190.5	188.0	204.0		194.3

*estimate

Results

1. The number of parked cars at each interchange under observation was counted on three separate days within a period of one month. Volumes varied little from count to count as shown in Table 1.

The result of this particular aspect of the study is interesting in that although volume counts remained steady, license checks and questionnaires answered indicated that an unexpectedly large number of cars parked in these locations only for a few days. At the interchanges covered by the mail survey technique, a high turnover between the checks was anticipated because of the possibility of encountering "new" parkers who had actually been drivers during the first check, as explained earlier. However, at the three interchanges which had been investigated first by the direct interview method during which time the license plates of both the parkers and the drivers were recorded, a high turnover was not expected. Yet many new parkers were encountered during the subsequent visits. For example, Whitney Avenue shows only eight repeats out of an average of 17 cars, or 47%; Whalley Avenue 16 out of 38, or 42%; and at Derby Avenue only three parkers were found at the interchange during the second visit out of the 19 that were there before, or a 16% repeat. This latter case is partially explained by the fact that there was a high per cent of "temporary" parkers. "Temporary" was defined as parking at one particular interchange for less than 3 months' time. Parkers were asked whether or not they parked regularly. Out of 161 replies, 109 were classified as regular (68%) and 52 as temporary (32%). The relatively large percentage of temporary parkers indicates that they have to be taken into consideration when parking facilities at interchanges are designed, especially since they tend to shift from one spot to another depending on their job demands.

2. The mean parking time for the whole study was 10 hours. Seventy-one per cent of the parkers arrived at the interchanges between 7 and 8 A.M. and 77% returned to pick up their cars between 5 and 6 P.M. Temporary parkers, such as construction workers, tended to arrive before 7 A.M.

3. A sample of 102 usable questionnaires indicates that the average distance traveled from home to work was about 30 miles, one-fourth of which was the distance from home to the interchange.

4. With few exceptions, parkers said they parked their cars at the interchange from Monday through Friday only. All park there through the winter season; inclement weather apparently does not cause them to change their parking pattern.

5. The average pool car occupancy was 3.5 persons, white-collar workers and salesmen tending to form smaller pools (2 persons), while those in the building trades were inclined to form larger pools (4 to 6 persons).

Estimating Parking Demand At Interchanges

In order to estimate demand at future interchanges, a relationship be-

Figure 2
All-day parkers reducing roadway capacities on approach to interchange. Photo taken from parkway bridge—New Haven, Conn.

tween the average annual daily traffic on the secondary roads and the volume of parkers at interchanges was sought, but none was found. In some cases the road volume was high, yet there was not a single parker at the interchange. This led to the belief that the major factors influencing such parking are the sizes, distance relationship, and economic nature of the neighboring larger communities themselves. In the Bridgeport and the New Haven areas there were found 85 and 82 parkers, respectively. The two cities are both industrial in nature and have a population of about 168,000 each.

TABLE 2

Population Densities of Coastal Cities and Number of Parkers Found

Nearest City	Density (Population per square mile) 1958	Number of parkers
Bridgeport	11,589	85
New Haven	9,330	82
Stamford	2,324	16
Westport	872	9

Figure 3
All-day parking on shoulders along an approach to the parkway—Stamford, Conn.

However, the cities further west along the parkway are smaller and different in character, and did not have a proportionate number of parkers in relation to their population. For example, at Stamford, which is about half the size of New Haven (about 80,000 inhabitants), there were only 16 parkers or about 1/5 the number encountered in the vicinity of New Haven. The interchanges near the other two cities studied, Darien and Westport, although both have an estimated 1958 population in the neighborhood of 16,000, varied from two parkers near Darien to nine parkers near Westport. However, the difficulty of finding a favorable location for parking at Darien probably accounts for this large difference.

Population alone thus was not considered to be a satisfactory measure, and another measure was sought which would not only represent the size but also the character of the community. One of the best of such indices is population density since, for instance, high densities usually indicate lower incomes, people living crowded together in apartments instead of private homes, and with occupations similar to the ones we encountered during this study. Furthermore, high densities result in many people having to work outside the city and, where there is no transit system available or where fares are costly, many of these people use their automobiles and tend to reduce the cost of transportation by sharing rides and organizing commuter pools. For these reasons, then, population density was chosen as the index of the "character" of the city. An attempt was then made to ascertain the relationship between density of the city and the total number of parkers found at all interchanges at the outskirts of the city.

Densities of the four cities studied (Darien was excluded because of the abnormal conditions encountered there) are shown in Table 2 and were plotted in Figure 5 against the number of parkers found at the interchanges in the vicinity of these cities. The resulting straight line, however, should be viewed with caution because it is based only on a very small sample and because density is not the sole factor affecting the number of parkers in these locations. It is suspected that the relationship eventually will prove to be curvilinear, following more or less the path of a straight line at first and flattening out at higher densities.

In order to estimate demand at future interchanges by analogy to the locations investigated in this study it must be remembered that this study deals mostly with coastal cities, which have their own characteristics. If the cities are inland, the direction and distances of the locations of places of employment have to be established, in addition to the population sites and the socio-economic and occupational characteristics of the city which can be represented by population densities.

An additional field trip along the parkway east of New Haven resulted in data representative of inland cities, as shown in Table 3 below. This additional data did not show any clear relationship between population size and volume of parkers, either by itself or when considered in conjunction with the previously mentioned data on population volumes. The values were plotted in Figure 5 and it is worthwhile to note that the majority of these points falls under the straight line, indicating the wider dispersion characteristic of inland cities.

Conclusion

From this study it is evident that parking facilities near expressway interchanges are certainly a desirable feature and that in some locations at least, they should be mandatory. They should be able to accommodate a minimum of five to ten cars and in those cases where estimates show an appreciable demand, large enough facilities should be provided to accommodate it.

Further investigations are needed to ascertain more conclusively the type of relationship existing between population densities of the cities and the number of parkers at nearby interchanges. These investigations should attempt to define the relationships of urban socio-economic characteristics, densities, and parking demand. Density, regular growth, and especially induced parking then have to be considered, before a final estimate of parking demand at future interchanges is made.

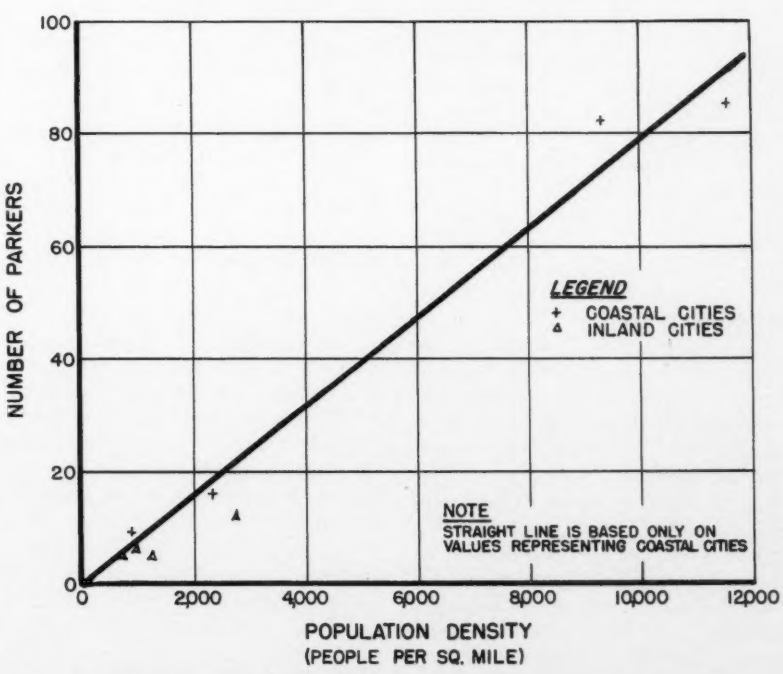
Failure to include interchange parking in expressway design has developed into a serious shortcoming, as shown by this study. Wherever such facilities are provided, parking on shoulders, adjacent grounds or on the roadways themselves will become unnecessary and should be strictly prohibited.

TABLE 3

Population Density of Inland Cities
and Number of Parkers Found at nearby Interchanges

Nearest City	Density (Population per square mile) 1958	Number of parkers
Wallingford	632	5
West Hartford	2,745	12
Manchester	1,447	5
Rockville	923	6

Figure 4
All-day parking on shoulders of a secondary road—Westport, Conn.



RELATIONSHIP BETWEEN POPULATION DENSITY AND NUMBER OF PARKERS AT INTERCHANGES

Figure 5

Traffic Forecasting for Developing Countries

By Dr. Salvador M. Padilla-Escabí
Puerto Rico

Since the Second World War, many regions and countries in the world have awakened from their economic backwardness and are eagerly looking forward to an improvement of their socio-economic conditions. The realization that world peace and growth cannot be sustained for long under such conditions, coupled to humanitarian goodwill, have forced developed countries, especially the United States, to undertake economic and other assistance programs to help underdeveloped countries.

Unfortunately many of the developmental schemes so devised are not too successful, due to two major reasons: First, there is a failure to establish an adequate governmental planning process to guide and coordinate the many social, economic, and administrative efforts that are needed to properly carry out these schemes. Secondly, many advisers from the developed countries blindly recommend, in the determination and implementation of projects, the adoption of techniques or methods of analysis that are appropriate for developed countries, but that lack application or must be modified to suit underdeveloped areas.

As transportation, in general, is one of the most important and fundamental factors in any developmental plan, and as highways are nowadays the most common and important transport media, the author long felt the need for a reevaluation of existing methods of estimating future traffic that would permit an intelligent approach to highway master planning in these countries.

In the case of many underdeveloped countries, it might be necessary to concentrate on the opening of the new routes of communication necessary for the development of their economy, in which case traffic demands will be only a minor factor in planning. However, in countries which have passed the initial stages of development, the highway master planning process must be based on appropriate forecasts of future traffic demands, so that the meager resources available in each country for transportation facilities can be properly allocated where they will produce the best results.

In the paragraphs that follow, an attempt is made to discuss existing methods of traffic forecasting and to present a new, or perhaps better called a refined, method for such purpose. Finally, an actual example[1] of the application of this technique to a developing country is described. It is also felt that the method proposed here is useful even in developed countries, especially in reference to regional planning.

Existing Techniques

The most common or standard method of forecasting future traffic in the United States has been to predict future motor vehicle registration on the basis of the past registration history and comparisons with population trends, past and expected. This prediction is then translated or transformed into a future travel estimate by the use of expected trends in gasoline consumption per vehicle and mileage traveled by gallon, based on past experience and foreseeable new technological developments. The travel estimate is subdivided by road systems, after which the overall traffic expansion factors for the various systems are computed.

Estimates made on this basis have proved in due time, even in the United States, to be nearly always incorrect and usually to be low.[2] An estimate,[3] made in Puerto Rico in 1949 in accordance with the method, contemplated a total registration of about 120,000 for 1970, a figure which was surpassed by 1957. It appears evident that a traffic forecast that relies only on past trends and not on prospective economic growth is not suited for proper highway planning, especially in developing countries.

Traffic forecasters[4] have fairly recently begun to take into consideration economic growth, the correlation being made on the basis of motor vehicle registration, as compared with the national income or gross product of economy. This method is undoubtedly a significant improvement over the standard method. A refinement[5] of this method suggests the use of the personal income (state and national) totals of the economy to make more accurate forecasts of future motor vehicle registration for the various states and regions of the United States.

The above described method, as well as the suggested refinement, can be used for traffic forecasting for underdeveloped countries. It was used by the author in his recently completed study of the improvement of the highway system of Puerto Rico. Its principal advantage is that it can be used for rapid and approximate estimates, while other techniques might be too time-consuming. Also, there might not be available more accurate or detailed projections than those of future national income totals, in which case other techniques might not be useful except with great additional expenditure of money and time.

The correlation between motor ve-

1 Padilla-Escabí, S. M., **A Plan for the Improvement of Puerto Rico's Highway System**, Ph.D. Thesis, Cornell University, September 1958.

2 Hansen, W. H., A Review of Travel Forecasts, **Highway Needs Studies 1957—A symposium**, HRB Bull. 158, Highway Research Board, Washington, 1957.

3 Highway Planning Division, Department of Public Works of P.R. 1949.

4 Holmes, E. H., What's Ahead in Traffic Volumes, **Proceedings** Institute of Traffic Engineers, 1950.

5 Lindman, B. H., Economic Forecasting for Statewide Highway Studies, **Highway Needs Studies 1957—A Symposium**, HRB Bull. 158, Highway Research Board, Washington 1957.

hicle registration and national income is not the complete answer to traffic forecasting for developing countries, because it does not take into consideration major inequalities in the distribution of the income produced by the economy, nor does it consider the cost of owning and operating motor vehicles with respect to other factors bearing on the very critical factor of overall living costs. These are items of extreme importance in developing countries where, in contrast to the United States and other developing countries, there are extreme income inequalities, both in absolute and percentage terms between the spending units and where, because of foreign exchange deficits, motor vehicle ownership costs exert greater influence on the cost of living of possible owners. The method described below tries to overcome these objections through the use of family income studies as they affect the registration of privately-owned passenger cars, which composes the most variable and, possibly, the most important motor vehicle group in terms of registration increases and highway demands.

New Approach

Before proceeding to describe in detail the technique proposed here, it appears proper to emphasize that traffic forecasting—as well as other forecastings—is especially difficult in developing countries. This is not only because of the lack of an adequate historic trend on which to rely or from which to obtain guidance, but more so because of the inadequacies of present research to correlate improvements in economic conditions with traffic generation. It is felt that the approach presented in this paper, which increases the accuracy of predicting future motor vehicle registration, is only one of the first steps, but a basic one, in overcoming such a need. Further improvements are needed in the techniques used to convert registration figures into traffic volume estimates.

As has already been explained, this technique is based on the premise that in examining the implications of economic growth on highway traffic, it is not only necessary to know present and future national incomes, but more important to have available fairly good estimates of family incomes. With these data on hand, it should then be possible to estimate the percentage of families owning cars in the various income groups.

With respect to national income statistics, most developing countries are making or planning to make adequate calculations, including family income determinations. Those countries that have proper planning agencies also have or can provide estimates as to future national and family income predictions. Where the planning process is inoperative, an examination of present production figures plus an analysis of the possible results of industrial and agricultural development schemes must be made, in order to obtain rough estimates of these factors. In such a case it might be easier to obtain or calculate and use national income figures and not to go into family income predictions but, whenever possible, all efforts should be made to obtain the latter.

The determination of the ownership ratios in the various income groups can be made by one or another or a combination of two methods. When available, the ownership ratios of areas or nations with similar living standards and similar car ownership and operating costs can be used, preferably taking into consideration areas that presently have or have had the economic levels contemplated for the future in the country under study. The other and more detailed method includes estimating the minimum cost of living in the particular place under study and the amounts available to match car and other consumer goods costs.

In both cases, and especially in the latter, great advantages could be derived from the consumer expenditure surveys which are typically conducted by labor departments or ministries or by social science research councils. If these are not available, it should not be too difficult to conduct a survey of motor vehicle owners and with a properly designed and small sample determine the ownership ratios by different income groups. These ratios, applied to adequate family income distribution projections, would offer very good estimates of future private passenger car registrations.

The forecasting of numbers of commercial and public transportation vehicles is normally less troublesome. It is believed that historic trends of their use and comparisons of their ratios to passenger vehicles in other countries or areas offer enough data for fairly good predictions. Also, the registration of these types of vehicles is more directly responsive to general economic indices such as national income projections than is that of the privately owned passenger vehicle. Any estimate concerning these vehicles, however, must take into account such factors as the extent, reliability, and cost of other competitive transportation modes; travel distances involved; degree and patterns of urbanization; condition and extent of the road system; etc.

Once the total registration predictions have been completed, it is necessary to convert them into travel estimates. Because of the lack of adequate research, it is necessary to use historic trends and comparisons with ratios in other places of average annual gasoline consumption per vehicle and mileage traveled per gallon of gasoline consumed. Again, use must be made of trends and comparisons for the subdivision of travel by highway systems (including rural-urban apportionments) from which the general expansion factors for converting present traffic volumes into future traffic demands are determined. Beside providing the traffic data needed for broad highway master planning of future facilities required, these expansion factors with modifications can be very useful in the detailed traffic estimates needed in the design stage of particular highway sections or projects.

The approach suggested here has one further advantage: It makes possible more adequate regional traffic estimates when there are great differences in regional economies. This is quite important in many developing countries where there are places—usually the capital and other major cities—with considerably better economic conditions and the typical traffic problems which result are not found in other areas of the country with lower economic standards. For this purpose, however, more precise data on the subdivision by regions of the national and family income estimates are needed.

An Example — Puerto Rico

Since World War II Puerto Rico has engaged in an ambitious program of economic development. Although much remains to be done, the efforts have proved successful in improving the welfare of its people. The gross product of its economy has increased from $287 millions in 1940 and $160 millions in 1947 to $1,204 millions in 1957. The per capita income is about 3½ times bigger than in 1940. The

offensive against proverty continues and, if the economic plans for the future become a reality, the gross production should reach $3,422 millions in 1975. This will result in a standard of living for its probable future population of 2½ millions similar to that enjoyed presently in the United States.

The dramatic social and economic changes witnessed in the island have greatly influenced the highway system which is the sole and vital internal artery of its social and economic development. The importance of the highway network, as a prerequiste for development, was recognized a long time ago and it has been continuously extended. In recent years the improvement in economic conditions has resulted in motor vehicle registration increases with the resulting growth in traffic volumes.

The future success of the economic development program will be in great part dependent on adequate transportation facilities and in Puerto Rico, because of geographic and other factors, this means a modern, efficient, and safe highway system. The decentralization of economic growth and the regionalization of government and other services throughout the island are especially dependent on an adequate highway system. In turn, the future economic growth will result in further traffic demands on the highway system. All these factors, coupled to the scarcity of developmental funds, emphasize the importance of foresightedness and accuracy in planning future expansions or modernizations of the system.

Puerto Rico's present highway system is very extensive. In 1957 there were about 6,360 kilometers passable by motor vehicle. This results in a ratio of 1.2 miles to one square mile of territory, which is very adequate for its size and compares very favorably with the ratio for the United States. Its 4,600 kilometers of paved roads are well distributed throughout the island. However, from the functional point of view, the major urban and rural roads are inadequate to serve present traffic volumes and will be more so in the future.

Motor vehicle registration increased from about 26,000 in 1940 and 41,000 in 1947 to approximately 123,000 in 1957. The present ratio of 18.6 persons per vehicle is rapidly decreasing and is only significantly worse than a few countries like the United States, Canada and Australia. In addition, there are some European countries that have somewhat better ratios. The approximate distribution of the registration is as follows: 60% are private passenger vehicles, 12% are public passenger vehicles and 28% are commercial vehicles.

In 1955, total travel was equally divided between urban and rural routes. Of the rural portion, the primary system, consisting of less than 12% of the rural mileage, accounted for about 54% of the total rural traffic. The secondary system, covering slightly over ¼ of the mileage, handled 27% of the travel, while the municipal and vicinal roads, comprising 60% of the mileage, carried less than 20% of the total rural travel. Of the urban portion, major urban routes accounted also for the greatest share of the urban travel.

The gasoline consumption in 1957 amounted to 1,085 gallons per vehicle. This figure is higher than the United States average for 1955 of 760 gallons per vehicle, but there were a considerable number of states that had consumptions over 800 gallons per vehicle. The reasons for this higher consumption in Puerto Rico probably are the higher proportion of commercial and public vehicles and the greater travel per vehicle in Puerto Rico.

Before making the traffic forecast necessary for master planning of the highway needs for 1975, an attempt was made by the author to determine the existing relation between family incomes and registration. It was fortunate that data from an income and expenditure survey, conducted in 1953 by the Puerto Rico Department of Labor, was available. Because of the method used to choose the sample, the overall results of that survey were not representative of the registration for that year. However, the author was able to select from the three portions of the sample one portion—that including persons reporting to the Income Tax Bureau—that probably was more representative of motor vehicle owners and that gave a total for private passenger cars that checked fairly well with actual registration. The results obtained in percentage of families in the various income groups owning a car are shown in Table 1.

In addition, to give a better perspective on the relationship between registration and income, it was felt advantageous to compare the existing relationship with that found in an area which presently has an economy similar to the one expected for Puerto Rico in the future. Because of Puerto Rico's political, economic and monetary association with the United States, it was considered that comparisons, with some adjustments, with certain areas in the mainland could be representative of its future motor vehicle ownership potential.

TABLE 1

Comparison of Motor Vehicle Ownership by Income Groups
Percentage of Families Owning a Car

Income	Puerto Rico 1953	Large U. S. Southern Cities 1950
Under $1,000	0	8
$,1000 - 2,000	7	17
$2,000 - 3,000		33
$3,000 - 4,000	36	53
$4,000 - 5,000		71
$5,000 - 6,000		81
$6,000 - 7,500	65	78
$7,500-10,000	70	88
$10,000 and over	82	84

Note: Information for Puerto Rico could not be subdivided for incomes between $2,000 and $6,000.

Sources: (1) Puerto Rican figures from basic data of an Income and Expenditure Survey by the Puerto Rico Department of Labor.

(2) U. S. figures from families reporting expenditure in cars in the 1950 Consumer Expenditures Study.

An analysis of economic data, especially in reference to family income distribution and cost of living, indicated that the southern part of the United States is the area in the United States with conditions most similar to those that Puerto Rico will have in 1975. Within the southern part of the United States, the large southern cities have population densities and income relationships most closely resembling those of Puerto Rico. Because of these factors, they were selected as the comparison standard for future Puerto Rican motor vehicle ownership. Their ownership - income relationships were obtained from the 1950-51 Consumers Expenditures Study of the U. S. Department of Labor and are also shown in Table 1.

This comparison is especially applicable with respect to ownership ratios in the higher income brackets. However, differences become greater in the lower income brackets. This is due to somewhat higher prices in Puerto Rico for consumer goods, especially food and durables, that reduce the purchasing power of families for such relatively expensive items as automobiles, which are more expensive in Puerto Rico than in the United States because of higher transportation costs and excise taxes.

Two different methods were used to predict the future motor vehicle registration. One was based on gross production estimates and the other on future family incomes. Figure 1 shows a line of regression diagram based on past motor vehicle registration versus gross production of the economy. As this method would only be used as a preliminary approach and as it was felt that Puerto Rico would not, in the near future, reach a saturation point in motor vehicle ownership, it was thus considered appropriate to use the straight line method. Based on the gross production estimate of the Planning Board, a figure of 465,000 vehicles was obtained as the 1975 registration.

The second method of forecasting was worked out independently of the first one. The 1975 distribution of families by income groups was obtained from economic planning data of the Puerto Rico Planning Board. For future ownership ratios, the author relied on the existing ratio and on the already explained comparison with areas in the United States that presently have economic conditions somewhat similar to those that Puerto Rico will have in 1975. Adjustments were made to take into consideration the local factors of the impact on low income families of higher motor vehicle ownership costs.

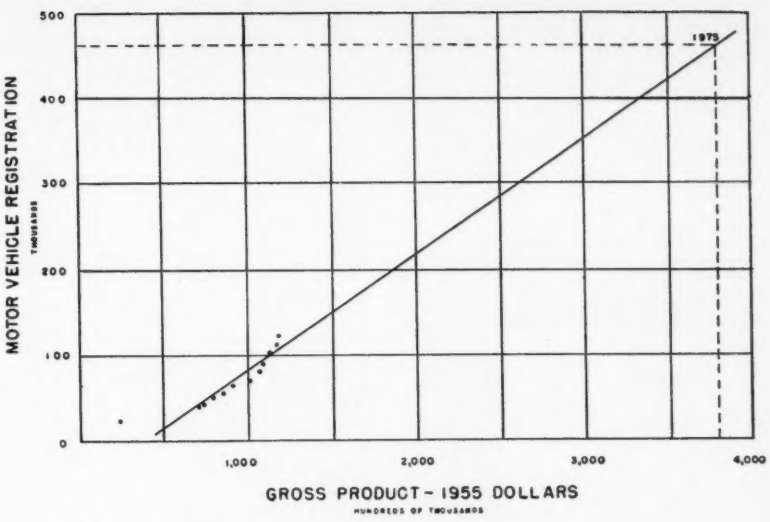


Figure 1

The estimates were based on three varying assumptions: (1) a very conservative estimate assuming the existing (1953) Puerto Rican ownership remaining the same; (2) a liberal estimate with increases in ownership ratios to resemble those of the comparison area; and (3) a moderate estimate falling between the conservative and liberal estimates. The details of the estimates of private passenger vehicles are shown in Table 2. Their respective 1975 private passenger (including driver-owned public service) car totals amount to 266,500; 332,000; and 307,000 respectively.

For the estimates of the public passenger vehicles, it was determined that, although the increase in private automobile ownership will reduce substantially the existing use of public passenger vehicles for urban, inter-city, inter-town, and town-to-city traffic, the improvement in economic conditions will result in an increase in trips per person that will partially offset this reduction. Also, there will be an increasing use of public passenger vehicles for urban taxi service that will help to offset the reduction in public passenger vehicles. Therefore, the author estimated that the number of public passenger vehicles in 1975 will be somewhat similar—6,000—to the present.

Due to lack of other competing freight services, the strong agricultural nature of the economy and the smaller ownership ratio of private passenger vehicles, commercial vehicles (including trucks) are expected to continue to be a high proportion of the total registration. There will be a small reduction from the present share of 28%, but the reduction should not be very great; even under the most liberal estimate it should not reach the 1955 United States average of 16.5%. The conservative estimate assumed reduction to 20% of the total registration by 1975, while the liberal and moderate commercial vehicle estimates were 25% and 22%, respectively. These percentages are generally in line with existing values for developed countries other than the United States that have economies more closely resembling that of Puerto Rico in 1975.

Table 3 shows a recapitulation of the different estimates. The lower figure of 340,000 should be reached without much difficulty. The more liberal estimate of 455,000 is very close to that of 465,000 obtained from the gross product projections and does not appear excessive. However, in order to be somewhat in the conservative side, the author selected the middle value of 400,000 vehicles as the probable registration for 1975.

Based on this estimate the population-registration ratio in 1975 will be about six persons per motor vehicle. This ratio appears reliable when one considers that the expected average living standards for Puerto Rico in 1975 are to be in the nature of those found in the United States in the early

TABLE 2
ESTIMATED 1975 PRIVATE PASSENGER CARS
BASED ON FAMILY INCOMES

Family Income 1955 Dollars (1)	Number of Families 1975	Comparable Ratio 1950 (2)	Conservative Estimate % Families Owning car (4)	Conservative Estimate Total	Moderate Estimate % Families Owning car (4)	Moderate Estimate Total	Liberal Estimate % Families Owning car (4)	Liberal Estimate Total
Under $1,000	22,566	8	0	0	0	0	2	500
$1,000 - 2,000	45,133	17	7	3,200	7	3,200	10	4,500
$2,000 - 3,000	73,340	33	36(5)	26,400	25	18,300	27	20,000
$3,000 - 4,000	95,906	53	36(5)	34,500	45	43,200	48	46,000
$4,000 - 5,000	95,752	71	36(5)	34,500	65	62,300	79	75,800
$ Over $5,000	231,303	80(3)	70	161,900	78	130,000	82(6)	185,200
	564,000	—	46	260,500	54	307,000	59	332,000

Notes:

(1) Information is available for these income brackets only.
(2) Based on families reporting automobile expense in large southern cities in the U. S.
(3) This figure is much higher for income above $7,500; does not show ownership of more than one car.
(4) Includes driver-owned public service cars.
(5) There is no break-down of existing ratios for these income brackets.
(6) Estimated so as to include ownership of more than one car by some families.

years of this decade, due allowance being given to differences in living costs. When compared with other developed countries, especially in Europe, the ratio also seems to be representative of the expected economic and registration conditions for Puerto Rico in 1975.

The selected estimate is almost twice as big as the official estimate that was being used by the Department of Public Works for their highway planning work and that had been obtained by the classical traffic forecasting techniques. It is felt that the new estimate will permit a more accurate appraisal of the magnitude of our future traffic problems.

As mentioned in the previous section, the merit of the technique presented in this paper is that it permitted a more conscientious determination of the probable future registration. The remaining part of the traffic forecast needed for the preparation of the master plan of improvement was based on commonly used methods of analysis.

The 1975 travel estimate was based on the probable gasoline consumption per vehicle and average per gallon of fuel consumed. Because of the smaller vehicle ownership ratio that results in more intensive use of public transportation and because of the higher proportion of commercial vehicles, it is reasonable to expect that the gasoline consumption per vehicle per year will continue to be higher in Puerto Rico than the present United States average. On the other hand, the significant increase in private automobile ownership should result in a reduction of the average annual consumption rate. Based on comparisons with the averages for some states which show somewhat similar economic and vehicle classification characteristics, it was estimated that the consumption will be about 925 gallons per vehicle by 1975. This value gave a total consumption for that year of about 370,000 million gallons.

The information available in Puerto Rico on average travel per gallon of fuel consumed is not too accurate. Because of the higher proportion of commercial vehicles and the fact that vehicles registered in Puerto Rico usually have longer lives than in the United States, it was decided to use a figure slightly lower than the United States average. The rate of 12 miles (19.2 kilometers) per gallon was assumed. Thus, total travel for 1975 will amount to 7,000 million vehicle-kilometers or 4,380 million vehicle miles. This would result in an overall increase in travel from 1956 to 1975 of about 200%.

It is very difficult to determine the distribution of future travel among the different systems. It is especially uncertain to estimate the rural-urban apportionment. In the case of Puerto Rico, the latter phase will be dependent on the degree of economic decentralization and regionalization achieved. As there is a consensus of opinion favoring the greatest development of such a program, it is to be expected that the necessary plans will be prepared and carried out. On this basis, it was estimated that the existing ratio of 50-50 will probably continue in the future. The absolute growth in urban travel will be concentrated in the major thoroughfares and streets of the cities.

With respect to the rural traffic, the

(Continued on page 50)

TABLE 3
SUMMARY
ESTIMATED 1975 REGISTRATION

Type of Vehicle	Conservative Estimate	Moderate Estimate	Liberal Estimate
Private Passenger	266,500	307,000	332,000
Public Passenger	6,000	6,000	6,000
Sub-total Passenger	272,500	313,000	338,000
Commercial	67,500	87,000	117,000
Total	340,000	400,000	455,000

Traffic News

Northwest Highway Engineering Conference—Oregon was host to the 1960 Northwest Highway Engineering Conference, held in Salem in March. Combining previously separate meetings of highway and traffic engineers, the Conference attracted 215 registrants. Pictured here are four of the speakers, l. to r., J. Al Head, Oregon State Highway Department; B. M. Finch, regional engineer, U. S. Bureau of Public Roads; Burton W. Marsh, American Automobile Association; and Martin P. Coopey, professor of civil engineering at Oregon State College.

Columbia to Conduct Driver Research

Basic research in driver safety is being conducted by Teachers College, Columbia University, with two grants, totaling $89,000, from the National Institutes of Health of the United States Public Health Service, Dr. Ralph R. Fields, Associate Dean of the college, announced on March 31.

The grants will finance two-year research projects on "Measuring Teacher Effectiveness in Driver Education" and "The Development of a Criterion of Driver Behavior." The studies, which got under way April 1, are being supervised by investigators with the Safety Research and Education Project at Teachers College.

Prof. James L. Malfetti, project executive officer, is directing the study on driver education. His group is also developing ways to measure the effectiveness of such training, including behind-the-wheel instruction. William Anderson is research assistant, and Prof. Robert L. Thorndike, head of the Department of Psychological Foundations, is serving as statistical consultant in this study.

Prof. Edward J. Shoben, Jr., with the assistance of Jerome L. Fine of the college, is directing the study on driver behavior. They will attempt to analyze the differences between "good" and "bad" drivers and develop a test to predict such behavior. They will also determine the relationship between driving and various social and psychological traits.

The two Federal grants will enable Teachers College to broaden its investigations in the traffic-safety field, Dr. Fields said. The Safety Research and Education Project, established in 1957, is currently conducting two studies, one on the rehabilitation of adolescent traffic violators, and the other on the practicality of using automatic devices and electronic roadways to prevent accidents. Both are being financed with grants of $95,000 from the American Automobile Association Foundation for Traffic Safety.

Dr. Fields said that the information the project hopes to obtain on differences between good and bad drivers and the simple test to predict such behavior should prove valuable in developing better licensing regulations and more effective safety measures.

MARBELITE
model
100
KEMCO PRESSURE DETECTOR

It's not just any day when you see an advertisement printed sideways . . . but then again it's not just any Pressure Detector you're reading about. There are so many nice things to say about our Model 100 Pressure Detector . . . take for example the low cost installation which requires a channel only 1½ inches wide and 1 inch deep . . . or the complete accuracy of the detector regardless of speed . . . or the fact that the detector is completely weatherproof and is not affected by snow or ice . . . FOR DETAILS PLEASE WRITE TODAY!

THE
MARBELITE
CO., INC.
173-179 NORTH 10th STREET
BROOKLYN 11, N. Y.
EVergreen 8-4742

Transit System Proposed For Los Angeles

Construction of a 43.5-mile rapid transit system over a five-year period, and the addition of some 110 miles to the network by 1980, has been recommended to the Los Angeles Metropolitan Transit Authority.

The program was submitted by the Authority's consulting engineers, Daniel, Mann, Johnson and Mendenhall.

The initial system as proposed calls for four routes extending generally northwest, east, south and west from downtown Los Angeles and would stretch out to North Hollywood, El Monte, Compton and West Los Angeles.

The full network outlined for construction in the next 20 years would consist of eight routes and would serve an area extending from Santa Monica on the West to Covina on the East, and from San Fernando on the North to Long Beach on the South.

The plans were given the Authority as part of a progress report from the consultants, who were retained last fall to work on several phases of rapid transit development.

In June, DMJM will report as to specific alignments along the four proposed routes, the type, or types, of equipment best suited, and cost estimates. The consultants stated that limits of the five-year plan have been tentatively set on the basis of maximum service with minimum capital cost. Further, extension through feeder bus service and "park 'n ride" operation achieved by increased parking space, provided at outlying stations, is anticipated.

C. M. Gilliss, executive director of the MTA, said the Authority will take no immediate action on the report, but will consider it along with other recommendations which DMJM will make in June.

Northwestern to Study Transportation Needs

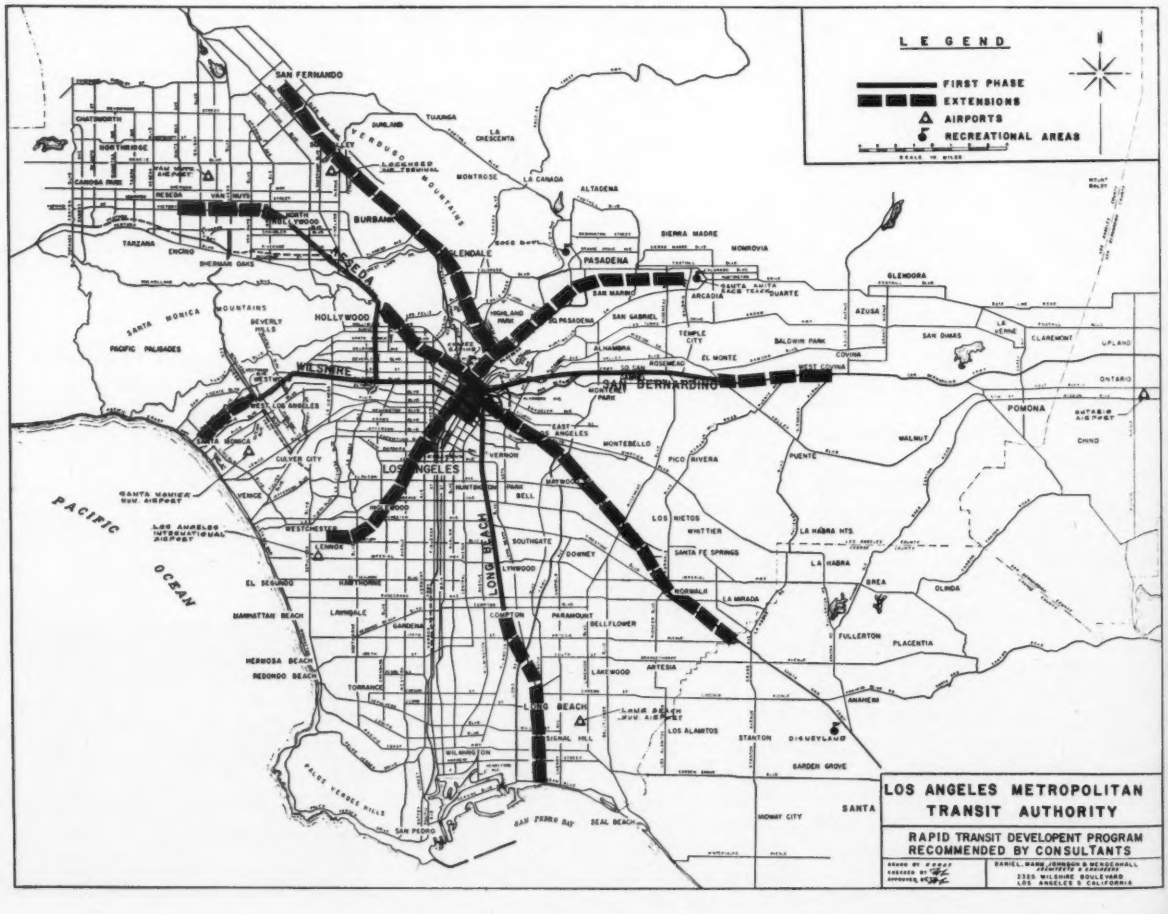
The Automobile Manufacturers Association has granted $85,000 to the Transportation Center at Northwestern University, Evanston, Ill., to study metropolitan transportation needs, Franklin M. Kreml, director of the Transportation Center, announced.

The study will cover the transportation requirements of the nation's growing metropolitan area.

"We are deeply gratified that the Automobile Manufacturers Association has granted the Transportation Center the funds to carry out this important research project," Kreml said. "Metropolitan transportation needs is a subject vital to the public interest as well as to the transportation industry.

"The metropolitan areas of the United States continue to expand relative to the nation as a whole," Kreml pointed out. "This process of growth in population and economic activity is altering patterns of land use, distribution of population relative to jobs, and transportation requirements in metropolitan areas."

Leon N. Moses, assistant director of research for the Center, said that the objectives of the study are to: 1. Determine the major factors that influence consumer demand for alternative forms of metropolitan transportation;



2. Investigate the major changes taking place in metropolitan areas and their implications for transportation requirements; 3. Investigate the relationship between major trends in inter-city transportation and metropolitan transportation requirements.

The Transportation Center is a national educational and research organization serving the transportation industry.

Utah Highway Dept. Publishes Folder

As another move in its safety program, the Utah State Department of Highways has published an illustrated folder for use of flagmen. The new leaflet has as its purpose the providing of uniform instructions for all flagmen working on highway construction and maintenance jobs in the state.

The new folder has been published by the Safety and Information Divisions of the State Highway Department. The instructions are fully illustrated in three colors. Keith M. Macfarlane, Safety Coordinator, reports that 2,000 copies of the leaflet have been received. They will be distributed to contracting firms as they are awarded construction jobs on the state highway system. It will also serve as a guide to maintenance crews of the Utah Highway Department.

The foreword of the leaflet states: "The job of being a flagman is an important one. The lives of workmen and those of the traveling public can be in your hands. This leaflet has been prepared to help you in understanding your official duties."

"STOP" — This octagonal sign in Bangkok is mounted on the left side since traffic keeps to the left in Thailand. Even one who could not read the Thai language would understand the significance of the message, however, thanks to the shape of the sign.

NSPE Supports Use of Consultants

"Highly erroneous and misleading" advice concerning consulting engineers was given to a House Subcommittee by the Comptroller General of the United States, the National Society of Professional Engineers has charged.

In a communication to a Subcommittee of the House Appropriations Committee, Paul H. Robbins, executive director of the engineering group, took issue with recent testimony of Comptroller General Joseph Campbell in which the latter states that "the extensive use of consulting engineers substantially and unnecessarily inceased the cost of that engineering."

Robbins pointed out that the National Society particularly objected to "blanket statements of the type resorted to by the Comptroller General in the absence of any attempt to offer documentation or evidence to indicate that the use of state employed engineers for similar work is less expensive to the state or Federal Government."

The 52,000-member engineering society executive cited a newly published survey report by the National Society's Functional Section for Consulting Engineers in Private Practice which "clearly refutes any statements or implications by the Comptroller General or others that it is less expensive for the state highway departments or the Federal Government to use state highway staff employees for engineering design as contrasted with contracting for the same work with private consulting engineers."

Robbins also called attention to sections of the Federal-Aid Highway Act which "clearly authorize the use of consulting engineers" in certain situations.

Traffic Dictionary To Be Published

A dictionary of highway traffic terminology will be published in mid-June by the Traffic Institute, Northwestern University, Evanston, Illinois.

The book, "Dictionary of Highway Traffic," will systematically show the differences and similarities among terms currently being used in the various fields related to highway traffic and traffic safety.

"This will be the first time that the several different vocabularies in the traffic field have been consolidated in a systematic fashion in one volume," J. Stannard Baker, Traffic Institute research director and author of the dictionary, said. William R. Stebbins, Jr., formerly of the Traffic Institute research staff, is co-author.

The book will be useful to highway planners, traffic engineers, vehicle manufacturers, lawyers, educators, police officials, judges, prosecutors, driver-license and motor vehicle administrators, journalists, armed forces personnel, students, legislators, mayors and city managers, and others.

Main purpose of the book is to improve communication among technical and specialized groups in the highway traffic field. The scope of the dictionary is limited essentially to the technical language most useful to all of them. For example, distinctions are drawn between such terms as "junction" and "intersection," "registration" and "licensing," and "supervision," "control" and "direction."

Advance orders for the 300-page "Dictionary of Highway Traffic," which is priced at $6.00, are being received by the Director of Publications, Traffic Institute, 1804 Hinman Avenue, Evanston, Illinois.

NSPE Adopts Policies on Collective Bargaining

The National Society of Professional Engineers recently adopted two policy statements which will be of interest to all engineers, one dealing with collective bargaining and the other with proposed labor legislation. The two policy statements are reprinted in full below.

Professional Responsibility vs. Collective Bargaining

Collective bargaining for professional engineers is in conflict with the basic principles of a professional individual.

The individual responsibility and independent judgment required of a professional engineer are incompatible with the regimentation fundamentally inherent in unionization.

Collective bargaining divides the members of the profession into hostile groups and promotes discord among members of the same profession.

Constructive relations between engineers and management, and the full development of professional engineers can best be accomplished through programs in cooperation with all elements of the engineering profession.

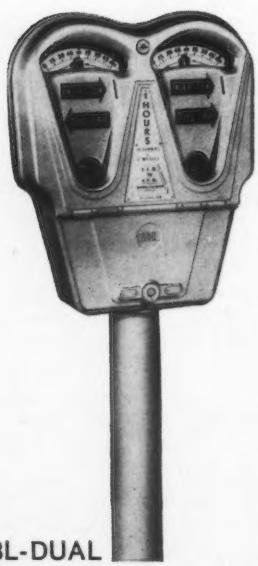
More than twenty years of experience and experimentation demonstrate

DUAL PARK

another fine

ROCK

Which is your best investment:



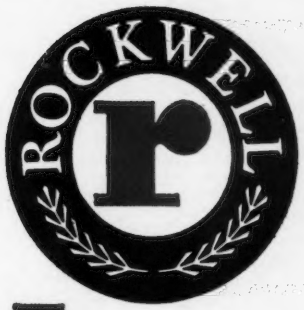
DUBL-DUAL

AUTOMATIC

MANUAL

ING METERS

product by



WELL

product or trademark?

The most important "feature" of any product is the company that produced it. Certainly Rockwell-Dual Parking Meters offer outstanding product features . . . solid brass clock works, stainless steel "guts," five-coin combinations and a host of other innovations that make these meters an investment rather than an expenditure for your community. But the name "Rockwell" on these meters means even more. It is your assurance of helpful know-how and practical experience based on serving municipalities with water, gas, and parking meters *for almost half a century*. It is your assurance that 13 research and development centers and 23 modern manufacturing plants (Rockwell is the world's largest producer of measurement, time, and control devices) will continue to create the new products that will help you solve tomorrow's problems better and at lower cost.

A Rockwell-built Parking Meter is a *proven* product that carries a *proven* trademark—a trademark that means you can buy what we *say* as well as what we sell. Why not get complete details today on how Rockwell can help your community solve traffic problems and create new sources of revenue. Better yet, ask for an experienced Rockwell-Dual traffic consultant to help you survey your parking meter needs. Write: Dual Parking Meter Company, Subsidiary of Rockwell Manufacturing Company, Pittsburgh 8, Pa. In Canada: Rockwell Manufacturing Company of Canada, Ltd., Guelph, Ontario.

DUAL PARKING METERS

another fine product by

ROCKWELL

Publications List

The publications of the Institute of Traffic Engineers listed below are available from the headquarters office at 2029 K Street N.W., Washington, D.C.

TRAFFIC ENGINEERING Magazine

TRAFFIC ENGINEERING is the official monthly publication of the Institute. It contains original articles of a technical and semi-technical character dealing with traffic engineering and related subjects. It also contains digests of current traffic news of unusual interest, and personal news of members.

Subscriptions ..... $4.50 a year
Foreign Postage ..... $1.25 a year, all countries except U.S. possessions, Canada and Mexico.
Single Copies ... $0.50 each, quantities of 1 to 9.
$0.40 each, quantities of 10 or more.

PROCEEDINGS

The Annual Proceedings of the Institute contain copies of all papers presented at the Annual Meeting.

1959 Edition	$2.00	1952 Edition	out of print
1958 Edition	1.50	1951 Edition	$0.50
1957 Edition	out of print	1950 Edition	out of print
1956 Edition	out of print	1949 Edition	out of print
1955 Edition	0.75	1948 Edition	0.50
1954 Edition	0.75	1947 Edition	0.50
1953 Edition	0.75	1946 Edition	0.50

Set of 46, 47, 48, 51, 53, 54, 55, 58 and 59 editions—$5.00 per set.

YEARBOOK

The annual yearbook of the Institute of Traffic Engineers, containing a brief description of the organization, copies of the Constitution and By-Laws, and a list of the members with mailing addresses. Price $1.00 per copy.

TECHNICAL BULLETIN #1

"Adjustable Face Traffic Control Signal Head Standards."

This bulletin has been approved (October 16, 1958) as an American Standard by the American Standards Association. Price $0.50 per copy.

SUPPLEMENT TO TECHNICAL BULLETIN #1

"12-Inch Adjustable Face Traffic Control Signal Head Standards."

This supplement to Technical Bulletin #1 was approved by the Institute in January 1960. Price $0.15 per copy.

TECHNICAL BULLETIN #2

"Pre-Timed, Fixed Cycle, Traffic Signal Controllers."

This bulletin has been approved (October 16, 1958) as an American Standard by the American Standards Association. Price $0.50 per copy.

TECHNICAL BULLETIN #3

"Traffic-Actuated, Traffic Signal Controllers and Detectors"

This bulletin has been approved (October 16, 1958) as an American Standard by the American Standards Association. Price $0.50 per copy.

TECHNICAL BULLETIN #4

"A Model Performance Specification for Purchase of Pavement Marking Paint."

This bulletin was approved by the Institute in January 1960. Price $0.50 per copy.

PROPER LOCATION FOR BUS STOPS

This Technical Committee report of 1954 approved as a recommended practice has been printed as a 12-page pamphlet. Price $0.25 per copy.

INDUSTRIAL PLANT PARKING

A report of Technical Committee 6-F, approved in 1959 as a recommended practice of the Institute and reprinted from TRAFFIC ENGINEERING magazine. 8 pp. Price $0.15 per copy.

A GENERAL THEORY OF TRAFFIC MOVEMENT

A reprint of the 1955 Past Presidents' Award paper by Alan M. Voorhees, Traffic Planning Engineer, Automotive Safety Foundation. 16 pp. Free.

RESEARCH TO IMPROVE TOMORROW'S TRAFFIC

A reprint of the 1957 Theodore M. Matson Memorial Award paper by O. K. Normann, Deputy Assistant Commissioner for Research, U. S. Bureau of Public Roads. 16 pp. Free.

TRAFFIC ENGINEERING IN TOMORROW'S TRANSPORTATION

A reprint of the 1958 Theodore M. Matson Memorial Award paper by D. Grant Mickle, Director, Traffic Engineering Division, Automotive Safety Foundation. 8 pp. Free.

HIGHWAY SAFETY — A PRIMARY CHALLENGE TO TRAFFIC ENGINEERING

A reprint of the 1959 Theodore M. Matson Award paper by Charles W. Prisk, Director, Highway Safety Study, U. S. Bureau of Public Roads. 4 pp. Free.

conclusively that the individual engineer and the engineering profession are best served through reliance upon the professional concept of solidarity in service to the public welfare and avoidance of collective bargaining.

Professional Provisions Of Labor Legislation

The principles set forth below shall govern the consideration of labor relations problems as applied to specific cases or legislation:

1. No professional employee should be forced, against his desires, to join any labor organization as a condition of his employment or to sacrifice his right to individual, personal relations with his employer in matters of employment conditions. The prohibition of the closed shop in the present national labor law should be retained in future labor legislation, and the law should be amended to also prohibit the so-called "union shop" or "agency shop" requiring membership or dues payments by professional employees in a labor organization after employment.

2. Professional employees should be guaranteed the right in law to have a separate and independent vote to express their desire with regard to collective bargaining determinations. The present professional provisions of the Taft-Hartley Act (Sections 2(12) and 9(b)(1) are of the utmost importance to professional engineers and should be retained in future labor legislation. The application of the principle of independent professional determination should also be retained in legislation for special types of employees, such as legislation to permit special procedures for representation by unions in the construction industry.

3. Professional employees should be guaranteed the right to terminate and abandon union representation through the so-called "decertification" proceeding. The law should be amended to clarify the application of the present decertification right to professional employees represented by a heterogeneous union in order that the professional employee may obtain a separate vote on continued union representation.

4. Professional employees should be assured the right to advance their professional interest, in company with other professional employees in the same employment, through a nonbargaining association of professional employees which is not certified by the National Labor Relations Board for collective bargaining, nor recognized by the employer for that purpose. The Taft-Hartley Act should be amended to assure such freedom of association of professional engineers in nonsupervisory and supervisory capacities.

Personal

John R. Crosby Joins M. M. Dillon and Co., Ltd.

John R. Crosby, (Assoc. Mem., ITE) who has been with the New Jersey Turnpike Authority for the past seven years, has joined the Consulting Engineering firm of M. M. Dillon and Company Limited, Toronto, Ottawa, London and Windsor, as Traffic Engineer.

Mr. Crosby, who was born in Syracuse, N. Y., attended Hobart and William Smith College, and completed undergraduate work in Engineering with honors at Syracuse University. In 1949, he was elected to Tau Beta Pi, the national engineering honorary society.

John R. Crosby

Following graduation, he served as Staff Adjustor with the General Exchange Insurance Coropration. In 1952 he received an Automotive Safety Foundation Fellowship for the graduate course in Highway Traffic Engineering at Yale University.

In his work as first Assistant and later Traffic Engineer of the Turnpike Authority, he obtained wide experience in the field of traffic operations and has written a number of papers dealing with highway design, accident frequency and freeway operational problems. Married, with four children, he will live in Toronto.

Boate is Cited for Safety Leadership

Thomas N. Boate, (Affiliate, ITE), manager of the accident prevention department of the Association of Casualty and Surety Companies, was named on March 31 by the American Museum of Safety as recipient of the Arthur Williams Memorial Medal for "leadership in traffic safety."

The citation, presented at the banquet of the Greater New York Safety Council's annual Congress and Exposition, points to "more than thirty years of devoted service to the cause of safety" in the United States. Mr. Boate's traffic safety experience covers local and state governmental fields as well as extensive national activities. A gold watch accompanied the citation.

Safety-FIRST
SLOW
SCHOOL
SAFE-T-CONE
TRAFFIC GUIDES
Use SAFE-T-CONES wherever traffic is difficult. Proven and accepted by Federal, State and Municipal traffic authorities in hundreds of major cities.
All-rubber SAFE-T-CONES available in 3 sizes . . .
28-inch
18-inch
12-inch
Solid-color PVC Poly-Cones available in 18-inch and 28-inch sizes.
SLOW
Because of their handling-ease, SAFE-T-CONES are easily adaptable to all situations at a moment's notice. SAFE-T-CONES command attention. All-rubber cones can be painted or reflectorized.
For full information write
RADIATOR SPECIALTY CO., CHARLOTTE, N. C.

Presently a resident of Montclair, N. J., Mr. Boate was born at Carlisle, Pa., and started his career in the Pennsylvania Highway Patrol, where he rose to the rank of captain. When the patrol was merged with the State Police, he organized and headed the 1,000-man traffic division, becoming the personnel officer and judge advocate. Mr. Boate retired from the Pennsylvania State Police in 1944 and joined the staff of the Association of Casualty and Surety Companies, where he became manager of the accident prevention department, the position he holds today.

The extensive safety programs developed by the Association and directed by Mr. Boate have won national recognition.

Fellowship Awarded to John Gilbert Doolen

John Gilbert Doolen, associate planner with the Metropolitan Planning Commission of Knoxville, Tenn., has been awarded the second annual American Motors-Jaycee Fellowship in City Planning.

The 24-year-old Doolen, who was

John Gilbert Doolen

graduated with top honors from the University of Illinois in 1958, will use the fellowship to work toward a Master's Degree in city planning at the University of North Carolina. The fellowship provides full tuition plus a maximum stipend of $2,500.

Selection of Doolen was made from among candidates submitted by 15 colleges and universities with approved courses for graduate study in city planning.

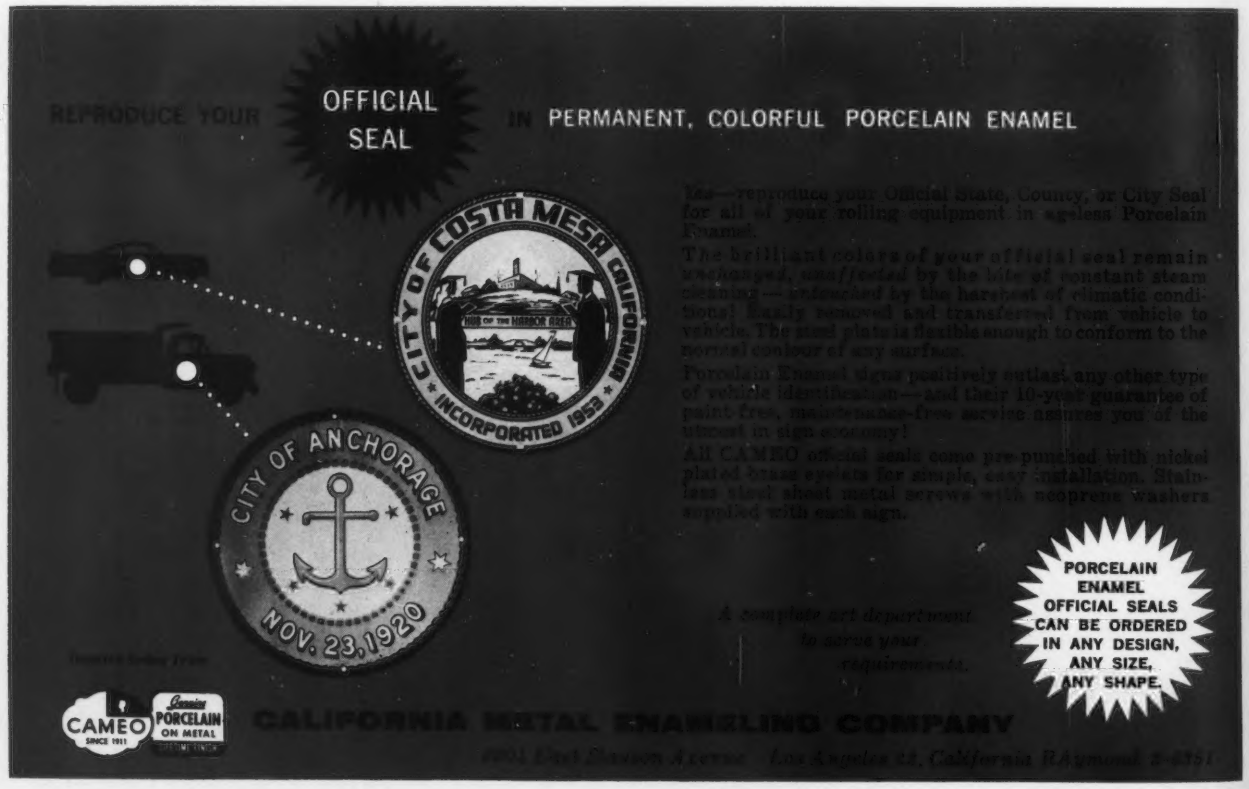
A committee headed by Charles A. Blessing, president of the American Institute of Planners, and including John Noble Richards, president of the American Institute of Architects; Dennis O'Harrow, executive director of the American Society of Planning Officials' and Alger F. Malo, vice-president of the Institute of Traffic Engineers, judged the applicants.

Doolen was born and reared at Kinmundy, Ill., and was salutatorian of his graduating class. At the university of Illinois, he was an active member of Alph Rho Chi, a social and professional fraternity of students in architecture and allied arts.

The American Motors-Jaycee Fellowship, which also provides a $1,000 cost-of-education grant for the school attended by the fellowship recipient, was established to help meet the critical need for more competent, professionally trained personnel for careers in city planning.

Title Changes

Barkev Karnig—is now Traffic Devices Engineer with the Ontario Department of Highways; was Acting Traffic Signal Engineer.


OFFICIAL SEAL
IN PERMANENT, COLORFUL PORCELAIN ENAMEL
CITY OF COSTA MESA CALIFORNIA
INCORPORATED 1953
CITY OF ANCHORAGE
NOV. 23, 1920
PORCELAIN ENAMEL OFFICIAL SEALS CAN BE ORDERED IN ANY DESIGN, ANY SIZE, ANY SHAPE.
CAMEO
PORCELAIN ON METAL

Sedat Mengiliboru—is now Deputy Department Head of Construction and Maintenance (Traffic) of the General Directorate of Highways in Ankara, Turkey; was Director, Traffic Safety Division.

Clyde W. Scott—is now Senior Assistant Traffic Engineer with the Cleveland Department of Public Safety, Traffic Engineering & Parking Division; was Assistant Traffic Engineer.

Job Changes

John R. Crosby—formerly Traffic Engineer with the New Jersey Turnpike Authority in New Brunswick, New Jersey; is now Senior Traffic Engineer with M. M. Dillon & Co., Ltd., of Toronto, Ontario, Canada.

Sven Kansman—formerly with Radar & Associates in South Miami, Florida; is now an engineer with Food Fair Stores, Inc., Southern Division in Miami, Florida.

Mart Kask—formerly Assistant Highway Engineer with the Washington State Department of Highways in Olympia, Washington; is now Associate Traffic Engineer with the Department of Public Works in Richmond, California.

Strictly Business

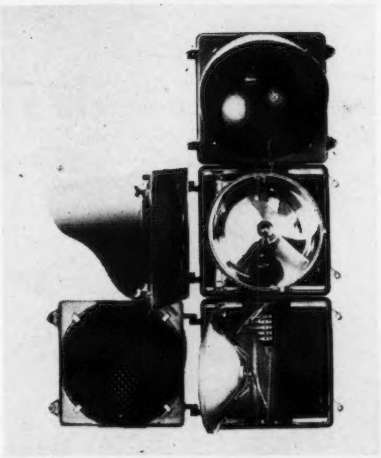
Traffic Signals, Inc, Announces New Signal Line

A new line of traffic signals and beacons is now available for the traffic control industry from Traffic Signals, Inc., Shreveport, Louisiana. J. F. Williamson, Jr., manager of the firm, announced the new line will be called the M-Series to denote the features of modern functional design, maximum safety, and maximum convenience in installa- and maintenance incorporated into the signals.

The 8″ and 12″ signals and beacons of the M-Series are functional and flexible due to their complete adjustability and interchangeability. The complete adjustability is obtained through the use of tri-stud mountings between sections and on mounting brackets for precise 360° adjustability (not in 5° steps) of each section or each signal head.

The 8″ and 12″ sections are completely interchangeable and can be mixed or matched as desired. Due to the design of the sections, 8″ and 12″ sections can be mixed and still have a smooth, professional-looking appearance. The smooth silhouette of a combination of 8″ and 12″ sections means background shields can be easily installed.

The M-Series incorporates several features contributing to greater traffic safety. These features are involved with the important areas of beam direction and pattern of the light beam to increase the distance of signal legibility. Beam direction can be controlled to a precise degree through the tri-stud mountings (mentioned above) for their



complete 360° adjustability.

The proper pattern of the light beam with relation to on-coming traffic is easily controlled with Traffic Signals, Inc. exclusive new Spring-Lok fixed focus socket. This Spring-Lok socket allows for proper filament location without the use of tools. The Spring-Lok socket is a new-design, fixed focus socket using spring tension to hold the toothed socket locked firmly in place. The filament can be accurately placed for the most efficient operation by pulling the lamp forward about 1/8″ to disengage the teeth, turning the lamp to the desired filament placement, releasing the lamp and allowing it to lock in place.

Installation and maintenance men are constantly hampered by weather, traffic, and an awkward location in which to work. Some of the features designed to simplify the job are as follows:

1. Door and reflector assemblies removable without tools. Electrical leads to sockets have Faston connections so not even a screwdriver is required.

2. Visor and lens removable without removing screws. The special large diameter visors are bayonet slotted so screws remain in housing.

3. Positive locking cam-action Dzus fateners that cannot be harmed by corrosion, ice, or paint, always open easily.

4. Stainless steel hinge pins for smooth opening door.

5. Single weatherproof Neoprene gasket seals reflector and door; reduces maintenance calls due to dirt or moisture in signal section.

Maintenance, Inc. Announces New Coating

A new colored coating which protects and improves the appearance of asphalt pavements, widely used in municipalities, is announced by Maintenance, Inc., Wooster, Ohio.

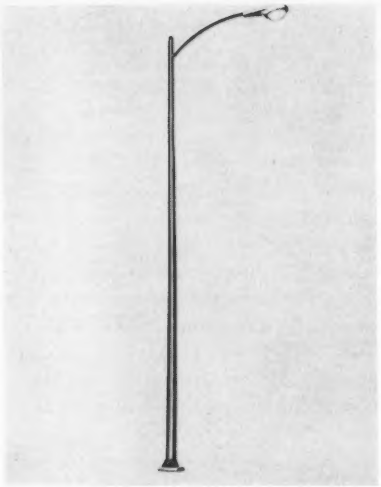
Known as Vynatex 23, it is available in grass green, concrete gray and brick red. The manufacturer advises that it creates a pleasing atmosphere and ofers release from undesirable limitations of black asphalt pavement appearance. It is also a remedy for shabbiness and drabness.

Vynatex 23 colors are said to be sunfast and non-fading. The material is claimed to guard asphalt surfaces against drying action of the sun, oxidation and freeze damage. Vynatex 23 is a companion product of Jennite J-16, a satin-black asphalt surface seal, used by cities for many years to protect asphalt surfaces. It is available in 5-gallon cans and 55-gallon drums from distributors throughout the U. S. and Canada.

For details, write Maintenance, Inc., Wooster, Ohio. Ask for Vynatex 23 bulletin L-1828A. Also, General Application Specification, Index VA.

Valley Manufacturing Co. Adds New Products

A complete line of tapered steel lighting standards, mast arms and brackets for street, highway and commercial lighting installations is now being produced by Valley Manufacturing Company, Valley, Nebraska. Specific products include lighting standards, mast arms, bracket arms, strain poles, stadium lighting standards, hinged poles and signal support standards. The company will produce tapered poles in all



standard sizes and to all state and municipal specifications. These will include tapered poles in steel of 3, 7 or 11 gauge.

The company said that the tapered steel products will meet or exceed the highest standards of the industry. New manufacturing facilities include both metallurgical and physical testing as well as rigid process control standards. The company said that the decision to enter the tapered pole industry is the result of three factors: (1) The need for a midwestern manufacturer to serve the Great Plains and Rocky Mountain areas; (2) A tremendous amount of related experience as a precision fabricator of other tubular steel products including steel pipe from 6 to 16 inches; (3) The move is part of the company's diversification program which started in 1954.

Valley Manufacturing Company produces, in addition to tapered steel poles, prestressed concrete forms, steel pipe from 6 to 16 inches, automated irrigation equipment, farm machinery and paper industry equipment. The company has just completed a half-million dollar expansion of tubular fabrication facilities including installation of the well-known Thermatool process of high frequency electric resistance welding.

Full information, pricing and production schedules can be secured by writing Valley Manufacturing Co., Valley, Nebraska.

* * *

"When a man assumes a public trust he should consider himself public property." —*Thomas Jefferson*

For Flashing Signals and Beacons

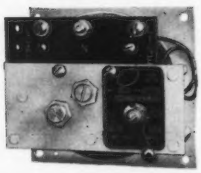
Specify The Flashers With Performance Proven Dependability

engineering and design features that have made Time-O-Matic the leading manufacturer of flashers since 1932

- open frame construction for efficient heat dissipation
- adjustable 50-60 flashes per minute
- not affected by extreme temperature variations
- slow speed induction motor
- hardened, polished pivots
- bearings, factory lubricated for life of the flasher
- available with or without radio interference eliminators

Write for literature and specifications

NEW ! !
Model 46
1 or 2 circuit, front-mounted cams and contacts out in the open for fast, easy adjustment, replacement. Compact size 4⅜" high, 4" wide, 2¼" deep

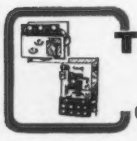


Model 3
1 or 2 circuits

Model 37 Jack-mounted
Available with or without meter base and cover, as shown, 1 or 2 circuits

Applications

Safety Zones
Caution Signals
Traffic Islands
Loading Zones
Warning Beacons
Flashing Stop Signs



TIME-O-MATIC, INC.
A SIGN OF GOOD CONTROL SINCE 1932
P.O. Box 850, Danville, Illinois, Phone Hickory 2-0611
Canadian Agent: Sangamo, Ltd. • Leaside, Toronto 17 Canada

Placed in groups of four to mark lanes on this elevated highway, Thio-Line traffic buttons afford high visibility day or night, in fair weather and foul according to the manufacturer. Buttons have an amazingly long service life.

Thio-Line traffic buttons are used on this California elevated highway ramp to mark lanes. Even in the distance the buttons pick up light and clearly mark the lanes. Made of polysulfide base material and glass beads, the buttons are applied with a special concrete adhesive.

Durable Traffic Buttons Described in New Bulletin

At least ten years service can be expected from a recently developed plastic traffic marker described in an 8-page bulletin prepared by Thiokol Chemical Corporation. Made of polysulfide base compounds and reflective glass beads, the markers are bonded to any pavement surface with a special Thiokol concrete adhesive.

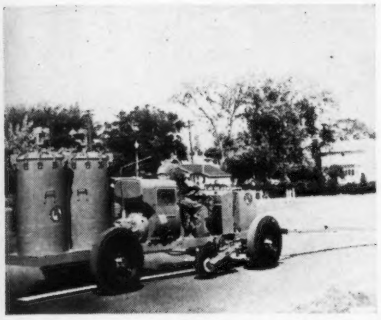
Illustrated in the bulletin are typical applications of these traffic buttons for crosswalks, street lane marking and highway lane marking. Cost comparisons with other marking methods, based on tests conducted since 1954, show that such buttons are considerably more economical over a 10 to 20-year period. The markers have shown a performance record of better than 99.98% —meaning that less than two out of every ten thousand have failed in the six year period.

Manufactured under the "Thio-Line" trademark, the raised reflective button surfaces are said to offer improved visibility at night and not blank out even in rainy weather. Step-by-step installation methods are described in the bulletin.

The "Thio-Line" Traffic Button bulletin is available free on request from Thiokol Chemical Corporation, 780 North Clinton Avenue, Trenton 7, N.J.

New Highway Marker Announced by M-B Corp.

A highly maneuverable, self-propelled, one-man operated striping machine —the Master 10 is now offered by the M-B Corporation, New Holstein, Wisconsin. Key feature is the machine width which is only 50″ overall so that traffic is not blocked in either lane, and unit can easily maneuver in heavy traffic and congested areas.



Designed for laying center lines on state highways, county roads and city streets, the Master 10 lays one, two, or three lines 3″ to 6″ wide, in one or two colors. Lines may be painted solid or intermittent with skip line attachment for automatic gun control.

Fast operation is assured with 3 speeds forward, up to 10 mph, plus reverse. Automotive type steering on two front wheels enables precision marking for new stripes and exact retracing of old lines.

The manufacturer states that outstanding features include powerful 21.-5 H.P. engine; 55 CF displacement compressor; folding "A" frame steering guide; 6:00 x 16-4 ply tires on all four wheels; hydraulic, internal expanding brakes plus jack shaft parking brake; automatic, air operated Binks paint guns; large 180 square inch strainer screen for each tank; and Model T6 Timer which provides independently adjustable cycles to paint guns and dispensers insuring perfect synchronization of beads and paint on skip lines.

The Master 10 carries two 60-gallon paint tanks or one 120-gallon tank. M-B Bead Dispenser with 360 lbs. capacity bead tank is available for reflectorized stripes. Dispenser is equipped with neoprene rubber cups which provide a safety feature against striking objects on roads. Dispenser also has a spinner hood to deflect spilled beads.

An M-B low bed, tilt type, two ton capacity transport trailer provides for easy loading and fast moves between jobs.

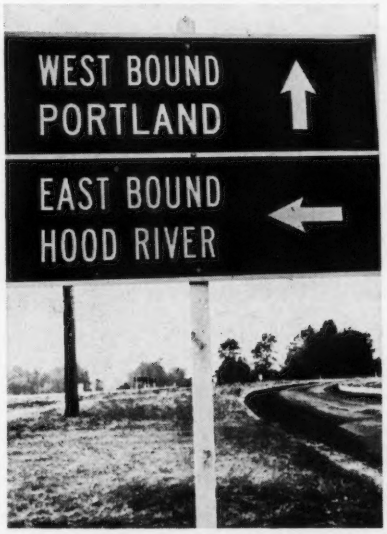
Complete information on the versatile Master 10 Line Marker may be obtained by writing the M-B Corporation, New Holstein, Wisconsin.

Kimberly-Clark Corp. Introduces Kimpreg 8000

A new development by Kimberly-Clark Corporation is being used in the production of a pre-finished sign type plywood.

Called Kimpreg 8000, the plastic impregnated material, which comes in green and white, may be laminated to one or both sides of a sheet of plywood. The result is a plastic surfaced plywood that requires no further finishing.

The product was thoroughly tested for weatherability by Kimberly-Clark and the Douglas Fir Plywood Association for periods equivalent to 12 years of outdoor exposure, with no breakdown of the surface, the company reported.

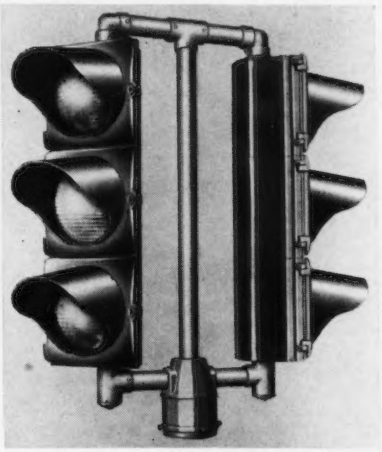


Because of its resistance to weather, abrasion and chemicals, plywood surfaced with this material is especially recommended for highway and commercial signs.

The sign grade material was developed to provide a long-lasting colorfast surfacing and is bonded to regular high density plywood. Natural colored Kimpreg covered-plywood has been used for many years for concrete forms, water front docks, truck bodies, industrial tanks and ducts, fixtures and cabinets, and other uses.

Traffic Signals with Self-Contained Units Available

Crouse-Hinds M-3 traffic signals have self-contained unit sections, making it easy to replace part of a signal. One-piece reflector assemblies snap out of the signal. Hoods are supplied with four bayonet slots to provide quick and easy installation and replacement. Removable stainless steel hinge pins



on the door are easily replaced. A cadmium plated forged bronze bolt on the door latch provides great strength.

An improved lens provides better light distribution. High polish Alzak aluminum reflector reduces weight and eliminates sun phantom. Locking rings are standard on all faces for permanent positioning. High winds will not rotate faces with locking rings.

Durable chassis design of Model M-3 resists adverse weather. Stainless steel, bronze, and aluminum are used in all vulnerable spots. Long-life door gasket provides weatherproof, dust-tight seal. Terminal markings are permanently cast on housing and cannot be obliterated, according to the manufacturer.

For more information on lightweight, durable M-3 traffic signals, write Crouse-Hinds Company, Syracuse 1, New York.

Cameo Highway Film Available to Groups

"Magic Highways—U. S. A." a 30-minute 16-mm color film complete with sound track produced by Walt Disney, is being offered at no charge for showing before traffic engineering and highway groups by California Metal Enameling Company, Los Angeles.

The film, created for television on the noted "Science" series, traces the

Have You Ordered Yours?

A HANDY AND DISTINCTIVE BINDER FOR 12 ISSUES OF TRAFFIC ENGINEERING

Now you can build an easy reference library to the many fine articles and technical reports which appear in TRAFFIC ENGINEERING. Slip each monthly issue into this handsome new blue and gold binder. It holds up to twelve issues, and will make a most attractive addition to your office or home library.

The binder has twelve removable steel rods which are easily operated to put copies in (or to remove them if necessary). The binder is beautifully finished and has a reinforced stiff back which is lined for greater wear.

order yours today **$3.00** **postpaid**

TRAFFIC ENGINEERING 2029 K Street, NW, Washington 6, D.C.

Please send me ..... binders, postpaid.

I enclose $..... ☐ Bill me.

Name .....

Please Print

Address .....

City ..... Zone ..... State .....

growth of the American highway system from 1901 to the present—and projects it into the future. Problems of traffic growth and control are fully treated, with various newly developed devices and techniques, dramatically presented.

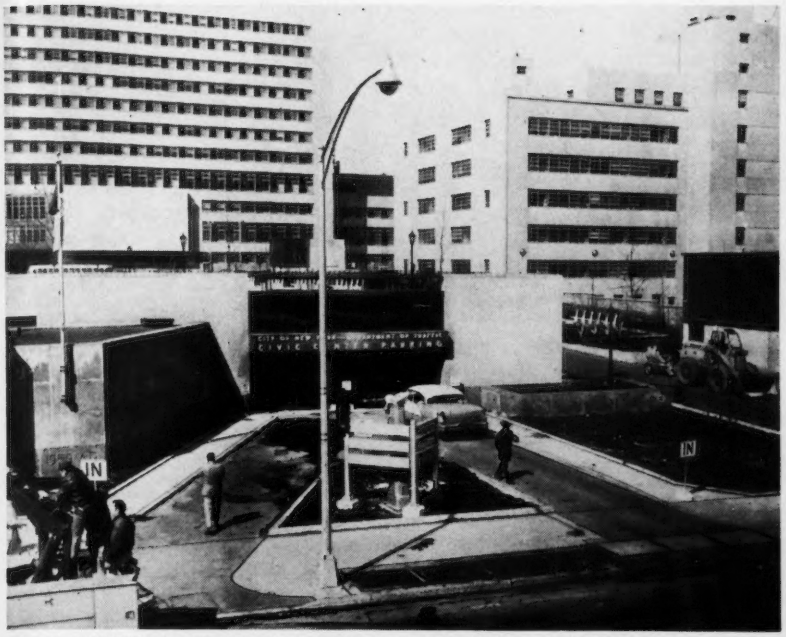
Cameo offers the film, without charge, on a loan basis as an industry service. To obtain it for showing before a highway or traffic group, write well in advance, stating date needed, group to whom it will be shown, and individual who will be responsible for receipt and return of the film. Address Hugh Penton, California Metal Enameling Company, 6904 E. Slauson Avenue, Los Angeles 22, California.

Mowers Feature Wide Area and Steep Grade Cutting

Heavy growth on 30 degree slopes is effectively mowed by this rugged unit cutting up to a 60 inch swath in one pass. Designed for heavy duty grade mowing such as highway ground maintenance and other similar terrain

where grades and ground angles make mowing troublesome and difficult, this completely new Devere TR series rotary mower is available in 37, 48 and 60 inch widths with variable speed drive from 2 to 6 mph, one reverse independent of cutting unit. Three staggered, heat-treated steel cutting blades are mounted in a pivoted cutting unit designed to follow ground contour. Other features include: Three pinion differential completely sealed against dust and dirt; vee belt cutter drive unit designed for 100% overload; over-bearings; side trim; adjustable cutting height 3/4" to 4"; adjustable front guards, floating rear guards. Unit has 9 HP four cycle engine, 12½ HP engine optional.

These new mowers are manufactured by The Devere Company, Racine, Wisconsin.



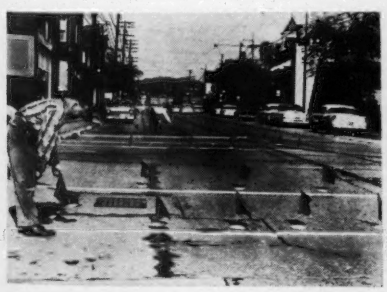
FIRST UNDERGROUND MUNICIPAL PARKING GARAGE DEDICATED BY NEW YORK CITY. Crowned with trees and a park, situated in the downtown business section on the approaches to the Brooklyn Bridge, this $2.5 million construction at Jay St. and Myrtle Ave., Brooklyn, represents New York City's first underground parking garage completed under Traffic Commissioner T. T. Wiley's long-range plan to provide the city with 40,000 off-street parking places. Automatic revenue control equipment built by the Taller Cooper Division, American Electronics, Inc., Brooklyn, assures efficient toll collection in the new Brooklyn Civic Center garage and guarantees financial security of the facility, which has a capacity of 703 cars. —New York Journal-American Photo

"Packaged Protection" Offered by MSA

"Packaged protection" for traffic routing on streets, highways, and industrial plant aisles is offered in two new products announced by Mine Safety Appliances Company, Pittsburgh. One is a linemarker that "rolls with the punch" for application in traffic re-routing during periods of construction, temporary detours, or painting of new lines on public or industrial traffic lanes. The other is a reflective road marker for nighttime protection against accidents resulting from disabled trucks, buses, and trailers.

The M-S-A Linemarker is a 13½-inch-high flag assembly mounted on a highly stable cadmium-plated steel base. Pre-production tests have shown that the unit cannot be knocked over, broken, or moved when struck by passing vehicles. The spring holder returned the flagstaff to an upright position after every impact.

The M-S-A Signal-Lite Road Marker features a highly reflective aluminum panel mounted by means of a spring frame on a cadmium-plated steel base. A warning flag is attached to the top of the frame. The new safety unit is designed to collapse undamaged if accidentally run over, and can withstand wind velocities up to 40 miles an hour. Reflective surfaces of the unit meet Pennsylvania and Interstate Commerce standards for visibility at night.



NEW FLEXIBLE
GUIDE POSTS
CONTROL TRAFFIC WITH *SAFETY* AND *EASE*

TRAFFIC TESTED
Looks like steel . . . but bends without hazard or damage

New *Flex-O-Guides* reduce traffic hazards with remarkable results. A special reinforced rubber makes them tough to withstand weather and high speed impact of autos . . . even to 70 m.p.h.

LOW COST—INSTALL IN MINUTES

Exclusive snap-in and snap-out feature puts them to work full time or part time as you wish. 3 types in 3 sizes: 14", 20" and 26" heights with reflective yellow bands. For details and prices write:

FLEX-O-GUIDES

BELL AND GUSTUS, INC.
4328 N. ELSTON AVENUE • CHICAGO 41, ILL.

NO. 100 MODEL
STANDARD SURFACE TYPE

No holes to drill, no bolts to install. Mix equal parts of mastic and catalyst together (two parts of catalyst to one part of mastic when temperature is 32° or less.) Apply mastic to bottom side of casting flange and set FLEX-O-GUIDE in position. It takes a minute; anybody can do it.

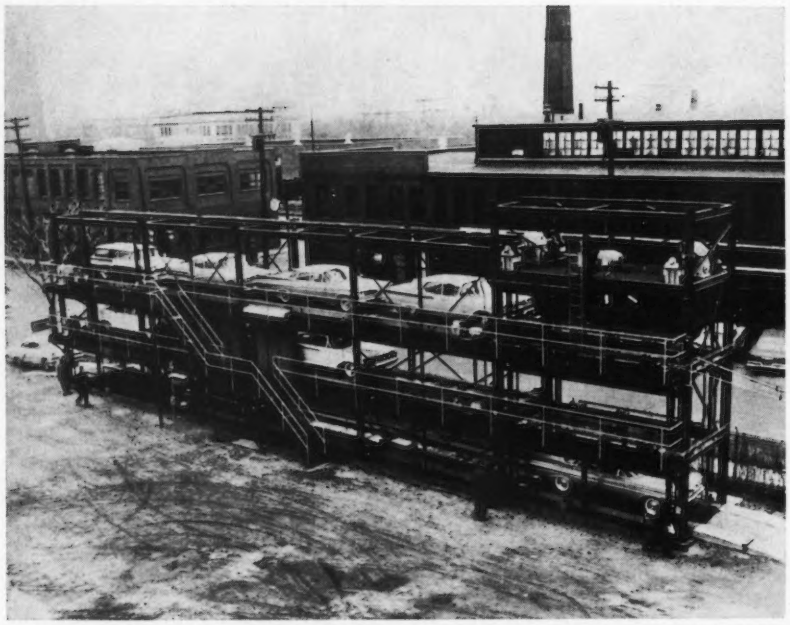
NO. 200 MODEL
SURFACE TYPE SNAP-IN

Same installation as No. 100 Model. The FLEX-O-GUIDE has place for a spanner wrench to be used for removal and installing FLEX-O-GUIDE.

A dust proof cover can be provided for 200 and 300 models, if required.

NO. 300 MODEL
BELOW SURFACE SNAP-IN

A five (5) inch diameter hole must be made in surface to the depth of three (3) inches. The female casting is then set in the hole with any fast setting cement grout. The FLEX-O-GUIDE has place for a spanner wrench to be used for removal and installing FLEX-O-GUIDE.



Push-button parking has become a reality in the yard of Taylor and Gaskin, Inc., Detroit, a firm specializing in fabricated steel and conveyor systems. This tri-level prototype of the facility, as yet unnamed, has proven successful in all tests and shakedown runs, according to Mervyn G. Gaskin, chairman. The device permits the driver to park his own car. An attendant pushes a button and everything is automatic until the driver returns and drives away from the deparking end of the unit. No one else has touched the car in the meantime.

Motorola Promotes Falls to Executive Post

Edward L. Falls, Jr. has been promoted to Executive Assistant to the General Manager of Motorola's Communications Division, it has been announced by Arthur L. Reese, Vice President and General Manager of the Division.

Falls, as a vice president of Motorola Communications & Electronics, Inc., a wholly owned subsidiary of Motorola, has been managing sales and service of radio communications products in the southern states.

In his new capacity with the parent company, Falls assumes responsibility for the continued development of the division's new products program, which includes closed circuit television and radio traffic control equipment.

Falls, with Motorola in various capacities for 16 years, is now headquartered in Chicago. He had been in Dallas, Texas.

Edward L. Falls, Jr.

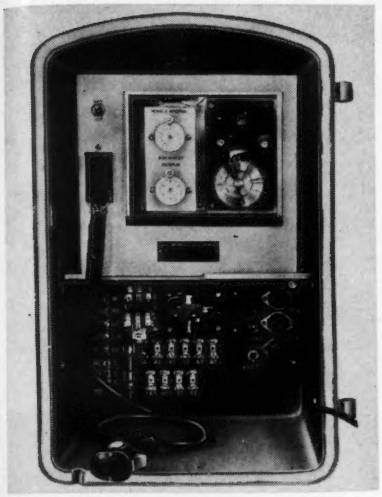
New Device for High-Precision Sequence Timing

A sequence timing board for actuating three stopwatches at precisely the same instant with a simple squeeze of the hand which carries the board, is announced by Heuer Timer Corporation, 441 Lexington Avenue, New York, N. Y. Based on a design devised and widely used by professional time-and-motion experts to collect "standard data," and called the Multi-Sequence Board, the apparatus is finding new applications in traffic analyses and many other classes of scientific, engineering, logistic, medical and sociological work.

The unit times sequential steps with zero time loss between those steps, and with no necessity to read timer hands while they are in motion. Proper procedure is to start, as in the photograph, with Timer 1 at zero, Timer 2 stopped at (and ready to fly-back from) any point other than zero, and Timer 3 in motion. Thus, each step under observation is timed *in* with the self-same motion that the preceding step is timed *out*—and the observer has the entire duration of any step to record "frozen" data from the previous one. The technique offers far more than convenience; it insures greater accuracy of data.

The Heuer board is of 3/16″ thick chipless black Plexiglas, shaped for maximum arm comfort. The three stopwatches are held between individual spring-loaded cradles and a common alignment plate around the stems. The actuators are knurled both at the contact pad and the upper locknut. Thus, adjustments are easy, secure and independent. The board boasts sturdy, heavily-plated metal parts, and a spring clip broad enough to delight any data taker. Watches and timers may be wound and operated without removal from the board. A left-handed model is also available.

When used with Heuer central-register decimal timers (illustrated) data are recorded in hundredths of a minute (and, by interpolation, in thousandths) for simplified "per minute" rate calculations. Both hour-decimal timers (for "per-hour" rate studies) and standard fifth-of-a-second timers are also commonly used with the board. The new board will accept any stopwatch of standard size. Start, stop and fly-back must be by successive depressions of the crown.



New Controller Introduced

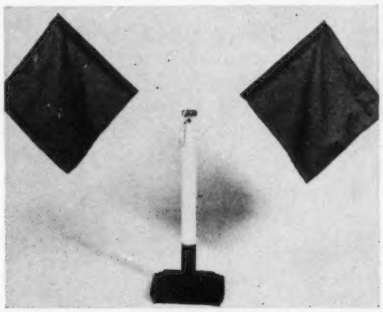
An electro-mechanical semi-vehicle actuated controller, is available from the Marbelite Company, Inc., manufacturers of traffic signal and control equipment. Used as a standard control unit, the M-20 SVA operates upon actuation of any type of detector in the street having the minor traffic movement. The versatile controller also operates as a pre-timed control using the recall circuit. The addition of accessory units provides for guaranteed pedestrian crossing time, operation in a progressive system, right flashing, shut down, fire lane and time switch control of these features. For additional information write to Sales Promotion Dept., The Marbelite Co. Inc., 177 North 10th Street, Brooklyn, New York.

West Side Iron Works Announces New Device

Traffic Island, a new traffic control device, is being introduced by West Side Iron Works, Inc., 327 Front Ave., N.W., Grand Rapids 4, Michigan.

Traffic Island has all-steel construction, with a heavily-weighted, non-slip black base. Main tube is yellow, with optional reflectorization. Red cap at top of tube is removable to permit storage of the two 16" x 16" red warning flags when the Traffic Island is not in use. Flasher may be installed for night-time use. Height of tube is 26"; wt. 13 lbs.

The manufacturer, West Side Iron Works, also produces the Guard-Gate barricade and other traffic safety devices.



New Publications

Proceedings, 1959 ITE Annual Meeting

29th Annual Meeting, Institute of Traffic Engineers, 2029 K Street NW, Washington 6, D.C. 1959. 272 pp. $2.00.

This publication contains a full record of the Annual Meeting of the Institute held in New York City in September 1959. Included are the keynote address by T. T. Wiley, the Matson Award paper by C. W. Prisk, the ITE Past Presidents' Award paper by Robert D. Conklin, and principal addresses by S. S. Taylor, Robert Van Hoef, Rex M. Whitton, and Edward S. Olcott.

Included also are reports from the several technical department meetings. Papers reported are those by Wilbur S. Smith, John H. Mitton, Charles H. Rex, Alan M. Voorhees, W. L. Carson, Thomas J. Seburn and Edward M. Hall. Work of Department No. 3 on school crossing protection is reported by Robert D. Dier. James H. Kell reports on work of the committee studying "Yield" signs, and Harold Marks on four-way stops. James B. Rudden summarizes thinking of a committee dealing with pedestrian intervals in traffic signals.

Other papers dealing with design problems are reported from John J. Dobolek, Maynard Glass, R. J. Desjardins and David W. Schoppert. Parking matters are discussed in papers by Eugene A. Barton, and by Robert W. Harris and Charles S. Michalski. Express bus operation on freeways is discussed by William R. McConochie. Various traffic control device design matters are presented in papers by Marble J. Hensley, Richard I. Strickland and Irwin Hart, William F. Bauch, Jr., George M. Webb and Wayne N. Volk, and E. W. Campbell.

Proceedings, 1959 WASHO Highway Planning Conference

8th Highway Planning Conference, Western Association of State Highway Officials, c/o Oregon State Highway Department, Salem, Oregon. 1959. 270 pp. (processed).

This report covers the Highway Planning Conference of WASHO held in Salem, Oregon in April 1959. It contains a full transcript of the papers presented there by Harmer E. Davis and G. P. St. Clair in the opening session, as well as papers from the four technical sessions.

Proceedings, Symposium on Alcohol & Road Traffic

Indiana University, Center for Police Training, Department of Police Administration, Bloomington, Indiana. 1959. 324 pp. (& index).

This volume is a full report on the Conference on Alcohol and Traffic held in December 1958 at Indiana University and attended by most of the technical experts on this subject from all over the world. Of principal significance is the resolution reported on page 275 of the document which says that impairment from alcohol begins at a blood-alcohol concentration of 0.05% and that at a concentration of 0.10% all individuals are impaired. This is a lower figure than the usually accepted one of 0.15%.

Highway Accident Studies

Bulletin 240, Highway Research Board, 2101 Constitution Avenue, Washington 25, D.C. February 1960. 56 pp. $1.00.

This bulletin contains five papers presented at the 38th Annual Meeting of the Highway Research Board, as follows:

"Statistical Determination of Effect of Paved Shoulder Width on Traffic Accident Frequency," by R. C. Blensly and J. A. Head, reports on research by the Oregon State Highway Department in the use of statistics to analyze the difference between the average accident frequency on sections with narrow paved shoulders (4 ft. or less) and on sections with wide paved shoulders (8 ft. or more).

"Factor Analysis of Roadway and Accident Data," by John Versace, is a further analysis of data presented by Schoppert in 1956, seeking to make apparent additional relationships among the roadway features while compressing the results into a small number of more universal motions.

"Accident Analysis of an Urban Expressway System," by A. F. Malo and H. S. Mika, applies to a typical urban expressway system analytical techniques developed for statistical studies of accident data on the Pennsylvania Turnpike.

"Interchange Accident Exposure," by S. M. Breuning and A. J. Bone, shows that for intersections, at least, conventional statistics are rather misleading because the exposure to accidents is not proportional to the distance traveled.

"Inventory Speed Responses and Prior Traffic Records as Predictors of Subsequent Traffic Records," by Harry W. Case and Roger G. Stewart. Results of this pilot study indicate that several of the associations between driving speed as reported by the individual, prior traffic records, and subsequent traffic records are much greater than would be expected by chance.

"Cuts maintenance to the bone"

PACKAGED SIGNS SPEED INSTALLATION

To the natural advantage of light weight, Tassco provides these aluminum signs in pre-arranged packages ready for installation. The easy-to-handle panels are assembled on the job site and mounted in a matter of minutes.

TASSCO

This is North Carolina's new Route 85, by-passing cities, moving traffic quickly with the help of a signing program by Tassco. The complete program consists of ground mounted and overhead signs. The signs themselves are increment sheet signs developed by Tassco especially for use on modern, high-speed roads. They can be had in any height or width and are designed to meet 100 mph wind loads. The use of increment sheets means new lows in the cost of both materials and installation. But what is most important, since the State has to bear the costs of maintenance, is that with 1193 signs, 501 sign supports, and with 9 large sign spans, not one drop of paint is required for maintenance.

North Carolina's signs feature the approved reflectorized green background with white AGA letters. However, reflective material or painted backgrounds are available in any type letters or symbols.

Helpful data, including a full color movie, is available from the Tassco-P & K Highway Planning Committee. Write for "Committee Data" today.

TRAFFIC AND STREET SIGN COMPANY

84 FOUNDRY STREET, NEWARK, N.J.

State Highway Organization Charts—1959 Revision

Special Report 53, Highway Research Board, 2101 Constitution Avenue, Washington 25, D.C. 1960. 50 pp.

This publication is a revision of Special Report 20 published by the Highway Research Board in 1954. Organization charts are included for all of the states (except Alaska and Hawaii), for the District of Columbia, and for Puerto Rico. State highway departments are now being organized in Alaska and Hawaii, but each of these states indicated that a chart showing a fixed organization would be premature at this time.

Although there have been few changes in the types of state highway organization since 1954, there have been numerous internal changes in the organizational structures. Many of these changes are apparent from a comparison of the current charts with the earlier ones, but many are not. For example, 26 of the 50 states now have utilities engineers in their highway organizations, but some of these are shown only on charts of individual bureaus, departments and divisions, as distinct from the over-all charts presented here.

As in the earlier publication, all of the charts included here were obtained directly from the states for this particular purpose. In a few cases, in the interest of uniform size, it has been necessary to reduce the size of charts furnished or make slight format change, but in most cases the charts have been reproduced exactly as furnished by the states.

Snow Removal

Bureau of Yards and Docks, U. S. Navy. Oct. 1953. 60 pages. (Order PB 161060 from OTS, U. S. Department of Commerce, Washington 25, D. C., $1.50.)

This manual outlines a systematic snow removal plan for airports and other facilities where prompt, effective clearance is imperative. Specifications and performance characteristics for a wide variety of snow removal equipment are listed. Photos show proper truck mounting for V-plows, one-way curved blade plows, high-speed reversible plows and many other assemblies.

Highway Laws — 1959

Bulletin 237, Highway Research Board, 2101 Constitution Avenue, Washington 25, D.C. January 1960. 29 pp. $0.60.

This bulletin contains the 1959 Report of the Committee on Highway

Laws, together with four papers as presented at the 38th Annual Meeting of the Highway Research Board, as follows:

"An Attorney General Looks at Highway Law," by Duke W. Dunbar.

"Codification of Federal-Aid Legislation," by Clifton W. Enfield.

"Revision of Highway Law in Illinois," by John A. Shaneman.

"A Summary Discussion of Proposed Revision in Minnesota Highway Laws," by Paul A. Skjervold.

THE ILLINOIS TOLLWAY

(Continued from page 13)

hicle accidents for 1959 shows that only one out of every 27,000 vehicles using the tollway in 1959 was involved in an accident. While the tollway has safety built into it because of its high design standards, two significant operating features are worthy of mention when evaluating the safety record. The minimum 40 MPH speed limit which is well enforced plus the general high level of patrolling by the Tollway Patrol, a special detachment of the Illinois State Police, are particularly important in assuring good traffic operations, and thus, safety.

Within a short period of time since the opening of the first portion to traffic, the Illinois Tollway has developed into a vital link in the Chicago Metropolitan Area highway network rendering top notch traffic service concurrent with large safety dividends. As the saying goes, "You take the highway, and I'll take the Tollway, and I'll get there safely before you."

Positions Available

NATIONAL SAFETY COUNCIL

Position: Senior Engineer, Traffic Operations, Traffic Department. Coordinate and direct work of several N. S. C. Committees in the field of automotive and traffic engineering.

Requirements: Bachelor's degree in engineering, with several years of experience preferred.

Salary: Open, depending upon qualifications.

Apply: Send resumé of training and experience, plus salary requirements to: Harry Porter, Jr., Manager, Traffic Department.

(Continued on page 52)

Technical Notes

USE OF NON-RECORDING TRAFFIC COUNTERS

By Basil Andrews, City Traffic Engineer,
Savannah, Georgia

In the use of traffic counters which do not record, but give only the total count for the period of operation, it is general practice to begin and end the operation of the counter at the same time of day so that the values will be for a whole number of days. This procedure involves some difficulties.

Suppose a man is sent out Monday morning to make a number of one day counts. It might take him an average of ten minutes to put down each counter and five minutes to drive from one location to the next. Difficulties in variable distances and working conditions will make these times vary greatly. The next day in taking up the counters he has a fixed time schedule to follow, yet the time it takes him to read and pick up each counter is generally quite different from the time it took him to put it down. The result is that he arrives at each counter either early or late, usually early. He may have only half a morning's work but must take all morning to do it. To do his work in a most conscientious manner he must contrive to waste half his time, which is not likely to make a good impression on the public or good working habits for the man.

There is a strong temptation for a man to make arbitrary "corrections" for picking up a counter early or late. This seems to be a poor system for getting reliable values and using manpower efficiently.

Because of these difficulties some traffic engineering departments use a different method. The man who operates the counters records the date, time, and initial reading of each counter. When he picks up that counter he records the actual date, time, and reading. The differences in time of day are compensated for by calculations in the office. It has been found good to have readings recorded in a loose leaf notebook with sections numbered to correspond to numbers on the counter cases.

To make the corrections the office personnel must know what per cent of an average weekday traffic comes in each hour of the working day. This is calculated by averaging the results of a number or hourly recorded counts, the more the better. To facilitate use of the values it is helpful to arrange them in a table like that shown in Figure 1. This data is in use for city streets in Savannah, Georgia. It may be found desirable to have different

FIGURE 1

Per cent of an Average Weekday

FROM \ TO	AM	9	10	11	noon	1	2	3	4	5 PM
	8	6.2	11.8	17.5	23.5	29.5	35.4	41.7	48.8	57.0
	9		5.6	11.3	17.3	23.3	29.2	35.5	42.6	50.8
	10			5.7	11.7	17.7	23.6	29.9	37.0	45.2
	11				6.0	12.0	17.9	24.2	31.3	39.5
	noon					6.0	11.9	18.2	25.3	33.5
	1 pm						5.9	12.2	19.3	27.5
	2							6.3	13.4	21.6
	3								7.1	15.3
	4									8.2

tables for different kinds of thoroughfares, or even to have different tables for certain roads, such as those serving recreation areas, parks, or shopping centers. We have not found this necessary in Savannah, Georgia, except for one-way streets. The values given in Figure 1 were calculated from 21 traffic counts taken at random from counts made in Savannah. Each count used covered at least three weekdays and most were for five days or more. All counts were over 2500 average daily total and were for both directions.

An important question is the amount of error introduced in using the average distribution figures. For the data shown in Figure 1 the standard deviations for the 21 counts are shown in Figure 2. The highest standard deviation for a one hour period was 1.69 per cent of the average weekday traffic. The standard deviations for two and three hour periods are also shown. For the whole working day, 8:00 a.m. to 5:00 p.m., the standard deviation is six per cent. Thus, if the counter was put down at 8:00 a.m. Monday and picked up at 5:00 p.m. Friday the full count would be divided by 5.57 (the 0.57 being taken from Figure 1) to get the average weekday traffic. The error in the figure "0.57" would be less than two standard deviations 98 per cent of the time. This is an error of 0.12 day. The true value, therefore, would be between 5.69 and 5.45 days 98 per cent of the time. This gives an error in the computed weekday traffic of plus or minus two per cent. The error would be less than this 98 per cent of the time. A two per cent error is of no significance in traffic counting. We feel that for counts of three days or more no effort need be made to reduce the error due to use of the data in Figure 1 for any two-way street in the city. For one day counts the situation is a little different, since errors of ten per cent are quite possible.

The standard deviations are highest for the peak hours, and higher during the morning hours after 6:00 a.m., than during the afternoon from 1:00 p.m. to 5:00 p.m. For this reason the traffic counters for one or two day counts in Savannah are being put out and taken in during the afternoon period, 1:00 p.m. to 5:00 p.m. This keeps the standard deviation under three per cent and the likely error under six per cent for one day counts and under three per cent for two day counts.

FIGURE 2

Data from 21 Hourly Recorded Counts

Period beginning	% of average weekday occurring in each hour	Standard Deviations For 1 hour period	2 hour	3 hour
midnight	0.9	0.42	.73	.92
1 a.m.	0.7	0.37		
2	0.4	0.23	.33	
3	0.3	0.14		.76
4	0.3	0.16	.69	
5	0.9	0.61		
6	2.9	1.52	2.55	3.07
7	6.4	1.69		
8	6.2	0.98	1.28	
9	5.6	1.30		2.75
10	5.7	1.17	1.84	
11	6.0	1.05		
noon	6.0	1.06	1.82	2.26
1 p.m.	5.9	0.87		
2	6.3	0.58	1.09	
3	7.1	0.78		2.02
4	8.2	0.68	1.77	
5	8.3	1.62		
6	6.1	1.13	2.06	2.57
7	4.8	0.98		
8	3.5	0.71	1.40	
9	3.1	0.72		2.10
10	2.7	0.83	1.40	
11	2.0	0.69		

FIGURE 3

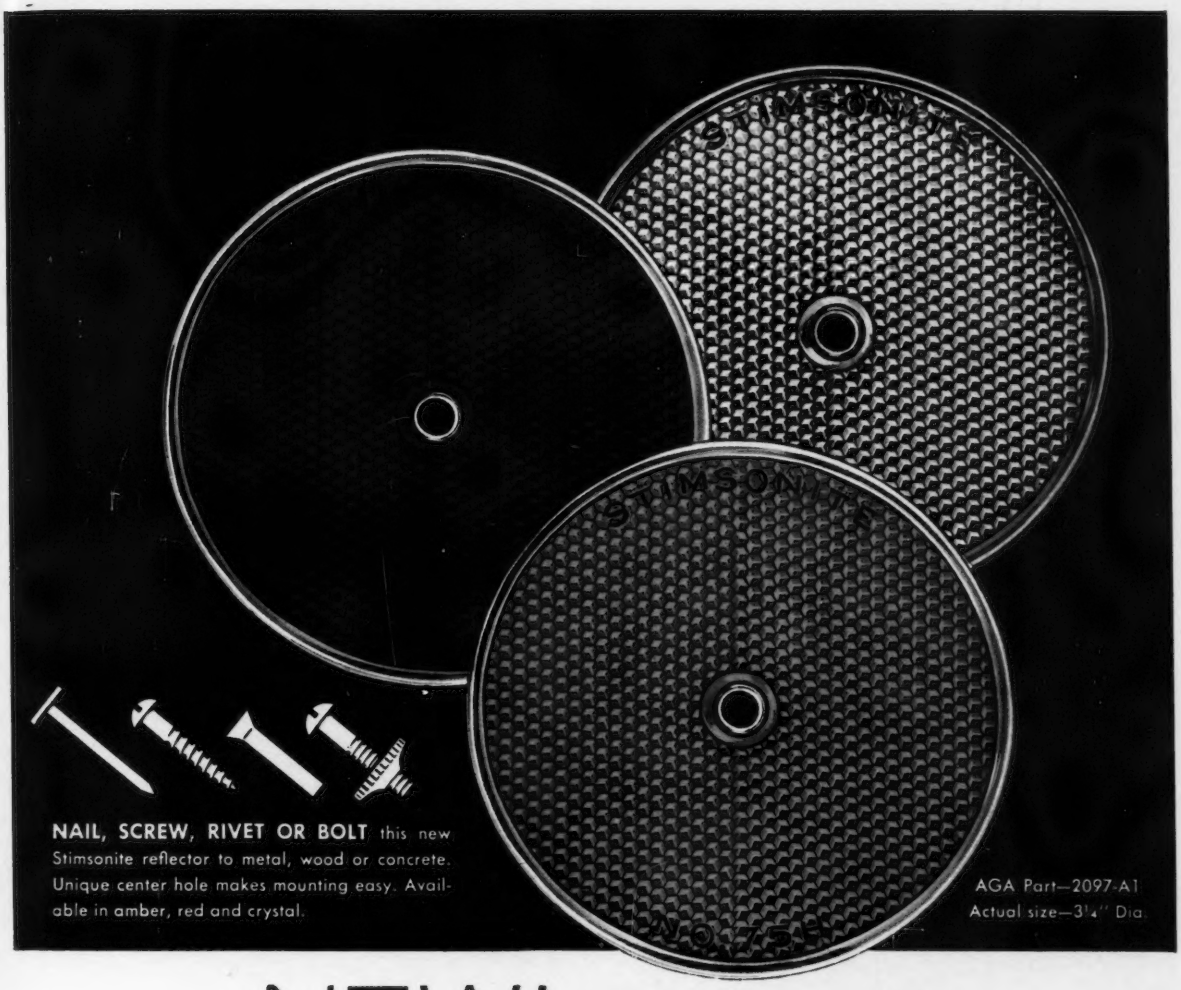
STATION No. 61

LOCATION: Barnard Street south of 37th Street

COUNTER No. 2

	1st period	2nd period	3rd period	TOTAL
STOP	10601	18286	22648	22648
START	7026	10601	18286	7026
DIFFERENCE	3575	7685	4362	15622
STOP TIME ..	1/29 1:25	2/2 3:50	2/4 3:25	2/4 3:25
START TIME	1/27 3:00	1/29 1:25	2/2 3:50	1/27 3:00
DAYS*	1.91	4.16	1.97	8.03
A.D.T.	1870	1850	2215	1950

*The fractional parts of a day are not computed by elapsed time but by average traffic as per cent of A.D.T. by use of Figure 1.


STIMSONITE
STIMSONITE
NAIL, SCREW, RIVET OR BOLT this new Stimsonite reflector to metal, wood or concrete. Unique center hole makes mounting easy. Available in amber, red and crystal.
AGA Part—2097-A1
Actual size—3¼" Dia.

NEW! STIMSONITE CENTER MOUNT REFLECTOR

The new Stimsonite reflector has a unique advantage permitting fast, easy mounting. You can use a screw, bolt, nail or rivet to mount this versatile new product on metal, wood or concrete.

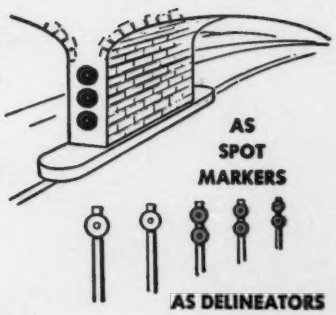
OTHER BIG ADVANTAGES:

Long range visibility—returns more light to source than any other reflector.

Hermetically sealed and housed in sturdy aluminum.

Noncorrosive and weatherproof.

Write today for bulletin with full details.



ESNA

STIMSONITE®

STIMSONITE SIGNAL DEVICES (AGA 1909-1959)

ELASTIC STOP NUT CORPORATION OF AMERICA

1027 NEWARK AVENUE · ELIZABETH 3, NEW JERSEY

When a non-recording counter is used for a count of several days or longer there is always some doubt as to whether or not the counter was operating properly for the whole period. It is good practice to check the operation every two or three days. A reading taken at each check can be used to check the reliability of the average daily total computed from the whole count. A counter can be operating when checked yet not operating between checks, due to cold nights or a vehicle parked on the tube. These check readings can be used to catch this kind of error.

A form used in computing the counts is shown in Figure 3. A comparison of the average daily total computed for sub-periods will reveal any serious errors. If readings are taken Friday and Monday the approximate relation of weekday to weekend traffic will be apparent. The methods described above eliminate the major sources of difficulty which so often make counts from non-recording counters unreliable. They also increase the efficiency of the use of these relatively simple and inexpensive instruments.

USE OF PLYWOOD FOR HIGHWAY SIGNS

Figure 1
New York State Thruway Authority: Medium Density Overlaid plywood with reflective border and figures.

Figure 2
Pennsylvania Turnpike Commission: Medium Density Overlaid plywood with reflective legend on non-reflective background.

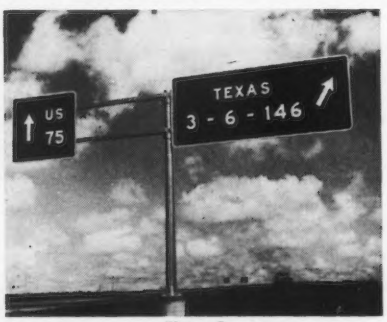


Figure 3
Texas State Highway Department: High Density Overlaid plywood with Stimsonite reflective legend applied directly to unpainted overlaid surface.

Federal, state, county and city agencies will erect an estimated 2 million traffic signs during 1960, either as replacements or new installations.

New street and highway mileage, plus increasing traffic demand on existing facilities, have intensified the need for more and better signing. And, of course, there will be the never-ending need for replacement of worn, outmoded or vandal-damaged markers.

Increased traffic densities, higher rates of speed, and consequently more severe visibility requirements on today's freeways and other major highways have introduced new problems in sign engineering.

Initial cost, expense of installation and maintenance are factors which will be more critically considered than ever before. This is particularly true where the Interstate System is concerned since, after installation, it is to be the state's responsibility to maintain the markers purchased on the 90:10 ratio of Federal to State funds.

While the Interstate System has reduced the number of regulatory and warning signs needed, the size of those found necessary will be increased. It should be noted, too, that the number and size of guide signs will be increased to cope with higher allowable speeds. Adapting available materials to new designs presents certain problems to the traffic engineer.

Sign faces must be kept free of obstructions; sign materials must be easily installed, yet capable of being easily replaced in either whole or in part, and panel sizes must be large to keep joints to a minimum. The basic materials should be permanent but of such a nature that costs will be low when the states must replace the units with their own funds.

Of the leading materials used in the manufacture of signs — aluminum, steel, and overlaid plywood—the latter is probably the least known and the latest to make an impact on the market. Since many states are now using plywood extensively, its advantages and limitations are worthy of discussion here.

Plywood, as a basic product, of course, is familiar. But the important technological improvements as applied to sign material are relatively new.

Medium and high density overlaid fir plywood panels have been given a surface of resin impregnated fiber. This provides an excellent face which is capable of being treated with reflective sheeting or paint. Overlays also prevent surface checking which in the past has been the greatest deterrent to the use of plywood as a sign material. They retain their recognized inherent strength and now have a smooth, lasting surface.

Only since the development of these plastic-like overlaid panels, has plywood become an important challenger in the sign material market.

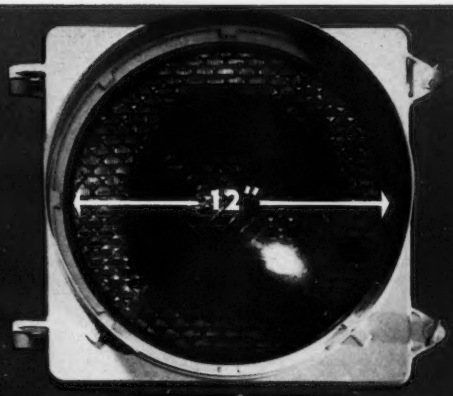
Overlaid plywood manufactured under the strict quality control standards of Douglas Fir Plywood Association is bonded with a phenolic resin. This bond is completely waterproof and is stronger than the wood itself.

Plywood is more resistant to vandalism than other materials. Modern day, gun-slinging Wyatt Earps play havoc with highway signs. Records show—Arizona, Oregon, New Mexico, among the many—that vandalism accounts for the greatest single maintenance expense to agencies responsible for the maintenance of highway signs. New Mexico suffered $25,000 in losses from vandals in one year.

Figure 4
Wisconsin State Highway Commission: High Density Overlaid fir plywood with Scotchlite reflective sheeting applied directly to overlaid surface.

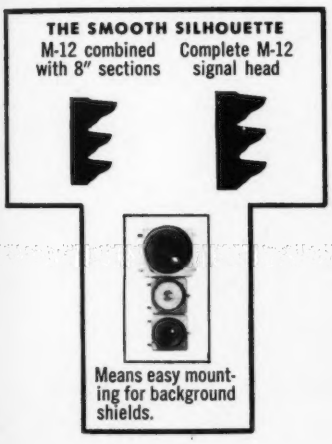
Specify The Signal Designed for Today's Traffic...

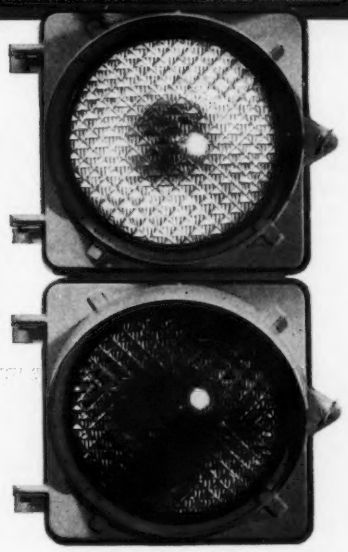
New M-12 Signals the Modern 12" Signal



for Modern Traffic Control
by Traffic Signals, inc.*

* FORMERLY SOUTHERN Signals INC.


THE SMOOTH SILHOUETTE
M-12 combined with 8" sections
Complete M-12 signal head
Means easy mounting for background shields.



MC Signal Head-12" Red
8" Amber & Green Sections

featuring:

- Exclusive Spring-Lok fixed focus socket with fingertip socket rotation for proper lamp filament placement.
- Original "Tri-Stud" section connectors—complete adjustability of individual sections.
- Two "Dzus" Aircraft type half-turn positive lock and quick release door latches.
- Extra diameter, oversize visors with bayonet slots. Rotatable 90°.
- Complete interchangeability between 12" and 8" sections for signals and beacons.

TRAFFIC SIGNALS
Adjustable
Fixed Face
Lane Control
Pedestrian Signals
Beacons
Downtown Beacons
School Signals
Barricade Systems

TRAFFIC SIGNAL CONTROLS
Pretimed Controls—Isolated or Interconnected
Actuated Controls—Semi-Full-Traffic Density
Pressure Detectors—Directional, Non-Directional
Magnetic Detectors—Surface, Subsurface
School Crossing Controls
Master Controls, Console type
Flashing Controls
Pedestals—Signals, Controls

WRITE FOR BROCHURE TS-101 COVERING M-12 SIGNALS AND BEACONS.

Traffic Signals, inc.

FORMERLY SOUTHERN Signals INC.

ADVANCED ENGINEERING IN TRAFFIC SIGNALS AND TRAFFIC SIGNAL CONTROLS

P. O. BOX 1303 • 222 BEACH STREET • SHREVEPORT, LOUISIANA 605

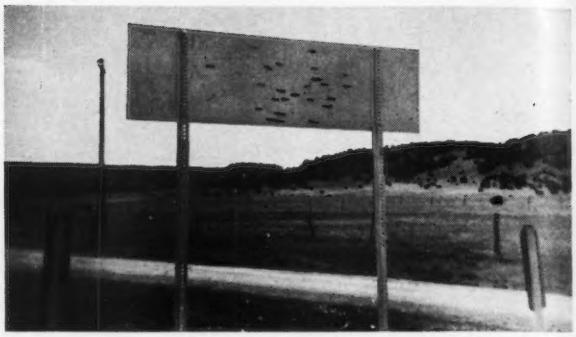


Figure 5
Modern day gunslingers have shot this medium density plywood sign full of holes — 25 in all. Minimum shock areas in plywood contribute to ease of repair as indicated on reverse side of panel.

Metal signs make attractive targets for bullets, rocks and beer bottles when a satisfying ring is produced. This, psychologically, invites vandalism. Little sound is given off from plywood, and it is thus less rewarding to the culprit.

Shock areas are excessively large on metal signs, sometimes four to five inches. Paint breaks down and rust may take over. Repair usually involves a total refinishing job. This is not the case with plywood.

J. A. Kennedy, Traffic and Safety Director of the State Highway Department of New Mexico noted in a recent report, "Bullet holes in overlaid plywood signs are easy to patch since the bullets do not cause the shock area that is so commonly found after a metal sign has been shot."

Photographs on these pages indicate the comparative damage and ease of repair on plywood materials.

According to Lawrence E. Thompson, chief traffic engineer of the Arizona Highway Department, one out of four signs has had to be replaced because of shooting damage. Vandalism from firearms has been cut appreciably, however, due to the simple combination of psychology and improved engineering. About 95 per cent of the department's signs are overlaid fir plywood.

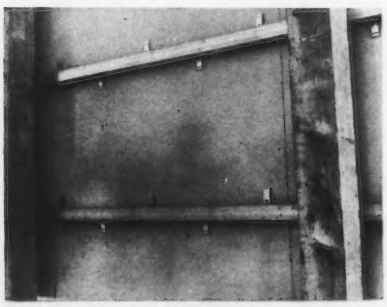


Figure 6
Aluminum plywood clips simplify the installation and maintenance of large multiple paneled signs. Single panels can be replaced without disturbing the rest of the sign.

Thompson also comments that the rust problem has been cut down since bullets go through without breaking the paint loose. He also suggests that it deprives the shooters of the satisfaction of seeing where their shots have hit.

Test results show that when finish is applied according to recommendations, plywood resists weather remarkably well. Kennedy of New Mexico reports that signs manufactured with overlaid fir plywood were placed in various locations, each picked because of the particular difficulties the department was having with signs in that area. To date, not one of these plywood signs has been damaged by weathering. Several years ago the department purchased over 7,000 square feet of $\frac{5}{8}$-inch overlaid plywood. Sample signs using this material were tested by a Weather-O-Meter. The commercial laboratory that performed the tests was asked to make a 3-year durability test. Plastic-faced plywood signs with edges sealed with varnish and aluminum, plus three coats of paint came through the accelerated tests in excellent condition.

Overlaid plywood is particularly adaptable to large control signs. Framing members can be minimized because of the inherent strength of plywood panels. Large panels help eliminate unsightly joints and contribute substantially to economy in installation.

Technological improvements, again, are noted. Plywood sign clips have been developed to provide simple installations for signs that might be fabricated either in state sign shops or by commercial fabricators. The new clips eliminate drilling through horizontal framing members and reduce the strict tolerance in fabrication. The sign clips can be used either in the shop or on the site.

These aluminum plywood clips are particularly helpful in the installation and maintenance of larger, multiple-panel signs. Clips make it possible to remove any one section of the sign without disturbing the rest. Since major damage to signs occurs in that area directly adjacent to the roadway, a single panel can be replaced without touching the rest of the unit. No special tools are required—a screwdriver and a mallet or hammer are all that is needed.

Plywood sign clips are available through normal plywood sources of supply or by writing to Douglas Fir Plywood Association, Tacoma 2, Washington.

One of the latest improvements in plywood has been the development of Kimpreg 8000 green, a prefinished green overlaid plywood. Since green is the required color for all destination signs on the Interstate System, this prefinished panel has some added advantages. The green is color fast and has been tested for accelerated weathering for periods of ten years and more.

Many states are using reflective legends on non-reflective backgrounds. This completely eliminates the need for painting the panels. Kimpreg green can, however, be reflectorized without difficulty and without excessive cost.

While new forms of plywood have their advantages, there are also some limitations.

Plywood is more bulky than other materials and requires more storage space. This is offset to some extent, however, by the fact that plywood can be inventoried in standard 4x8 panels and cut to desired sizes. Thus only one stock size is needed whereas metals must be stocked in several sizes and shapes.

No one material can answer all of the new problems that have been intro-

duced in sign engineering in the past few years nor solve all of these which are apt to appear in the future. The fact, however, that more than 30 states are using plywood on an extensive basis indicates that this new contender has some strong points in its favor.

More than likely all of the known materials, and perhaps some new ones, will have to be utilized to solve the current problems facing the traffic engineer.

An Inexpensive Wire Reel Carrier

By Allen B. Stephenson
City Manager, Alhambra, Calif.

The signal crew of the traffic division of the Engineering and Street Department of Alhambra, Calif. had long been in need of a more expeditious method of handling traffic signal wire. It was suggested by City Engineer R. G. Bezzant and Traffic Signal Foreman Charles Brackin that one of the bomb trailers available from surplus government property could be modified to meet this use. After inspecting these trailers and finding them usable and adequate for our purpose, negotiations were made for the acquisition of a trailer.

Alteration of the bomb trailer to a wire reel carrier was taken over by the shop superintendent. After an investment of approximately $200, the trailer was altered as shown in the accompanying photograph to handle the traffic signal wire reels.

This equipment in its recent use has proved a time saver and has greatly expedited installation of traffic signal wire. The reel carrier is designed to accommodate different sized reels and will handle 24 reels of traffic signal wire.

In a civil defense emergency, this wire reel carrier could be used to lay communications and power lines at a rapid rate to replace inoperable facilities.

Electronic Computers for Parking, Traffic and Transit Surveys

By Nils Rosén, Orrje & Co.
Stockholm, Sweden

With the aid of the Swedish EDP—Electronic Data Processing—equipment "Facit" the consulting engineering firm of Orrje & Co. in Stockholm, Sweden, has developed computer programs for parking, traffic and transit surveys.

"Facit" is a binary, electronic parallel computer. It has a mind consisting of:

I. One ferrit-mind with a capacity of 1024 words (with 40 binary figures).

II. Two trunk-minds with a capacity of 8192 words divided into 256 channels. The mind is used for stratification of both program and numerical datas. The input is done with a punched tape and the output can be done with an automatic typewriter or a punched tape.

The computer program for parking surveys is intended for the same basic survey as is usually made in America and which frequently is analyzed by means of punch card tabulating machines. Field work for the survey is usually undertaken on a typical business day and every automobile-driver, who parks in or adjacent to the central business district is interviewed concerning: 1. Origin of trip; 2. Destination of trip (to location of parking); 3. Trip purpose.

Other data noted by the interviewer are: 4. Time of arrival to parking space; 5. Time of departure from parking space; 6. Number of persons per car; 7. Location of parking; 8. Legality of parking as determined by comparison with local regulations.

Before punching these data on the tape that replaces the punch cards, the following steps are taken:

The data from 1 to 8 are translated into code-numbers and a ninth item of walking distance (or the distance between parking space and principal destination) is measured and translated into code-numbers. Automatic computation of walking distances was not possible because Swedish street numbers and our old street patterns are too irregular. Incomplete cards or mistakes are corrected as far as possible.

Computer input tape is then prepared including all information listed above as well as: 10. Block inventory of all available legal parking spaces within the cordon line. Each space is classified as a long-term or a short-term parking space. 11. Predicted parking demand increase factor. 12. Anticipated inventory of available parking spaces for the planning year (1970 or as determined).

Additional details could be included if desired. In the processing of the electronic computation, it is possible to get about 20 different tabulations or ready curves, which inter-relate the several variables and are of value in the development of a comprehensive traffic plan, of which the parking plan is a part.

Among the most valuable tabulations are those indicating long-term or short-term parking space surpluses or deficiencies for the design year on a block-by-block or area-by-area basis.

The advantage of an EDP-program as compared with a conventional punched-card program is chiefly in a reduction of man-hours expended in the procedure. This reduction is brought about by the fact that the EDP-computer can itself calculate, which most punched-card machines cannot do. The computer writes out all the ready tables.

The preparation of tabulations and graphs is greatly simplified as a result. Also the need for highly trained personnel to take the data from the tabulations and prepare tables and graphs is considerably lessened with the EDP-method.

Also eliminated with this method of operation is a determination of tabulations which will be of maximum value in presentation of the report findings. In some studies, certain tabulations are less valuable than in others, but since little additional time is required to get these tabulations from the computer there is no reason to omit them.

The costs for this part of the survey, machine-time included for one city in which 18,000 interviews were analyzed was about 8,000 Swedish crowns (appr. $1,600). To this should be added the cost for establishment of the program for the EDP-operation. As the program can be used for many cities, this cost can be spread out over them in the event numerous cities can be surveyed at about the same time.

For a complete comprehensive traffic plan however we also need other sur-

veys, such as O & D-survey and transit O & D-survey.

Therefore we have our O & D-survey program although it is somewhat less extensive. It can furnish us with all the information necessary for traffic assignment. The survey itself was developed by Göte Nyström, and it has already been used three times.

Finally Rolf Ahlberg in our traffic department developed a transit O & D-survey, which has been used in the city of Västerås. It has also been programmed for EDP-analysis in order to get headways, load factors, rerouting requirements etc.

TRAFFIC FORECASTING

(Continued from page 26)

major city-to-city highways included in the primary system are expected to carry about 50% of all rural traffic. Routes serving town-to-city and town-to-town traffic, the majority of which are included in the secondary system, would probably account because of their considerable length for about 35% of all rural traffic. The municipal and vicinal (farm-to-market) roads, although comprising the bulk of the rural system, are expected to carry only about 15% of that type of travel.

Because of the lack of proper research tools to correlate growth in travel with growth in traffic volumes for the different roads, it is only possible to determine approximate growth indices for different road systems; these can then be modified in the detailed studies of individual roads or sections. It was determined that while total travel will increase 200% by 1975, the distribution of this growth will be unevenly distributed by systems.

The estimates of the expansion factors for the various systems was based on: (1) a study of the future distribution of population and of agricultural and industrial employment and income; and (2) comparisons of the estimated future travel for each system and the present travel, consideration being given to the changes in the lengths of the various systems. For the major urban routes and the primary system, the expansion factors selected vary between 3 and 4. The expansion factors for the major town-to-city routes of the secondary system were estimated to vary between 1.5 and 2.0, while the local roads were estimated to have factors in most cases not considerably higher than 1.0.

Coming Events

July 17-20—WESTERN SECTION, ITE—
Annual Meeting, Jack Tar Hotel, San Francisco, Cal. Contact: Ross T. Shoaf, City Traffic Engineer, San Francisco, Cal.

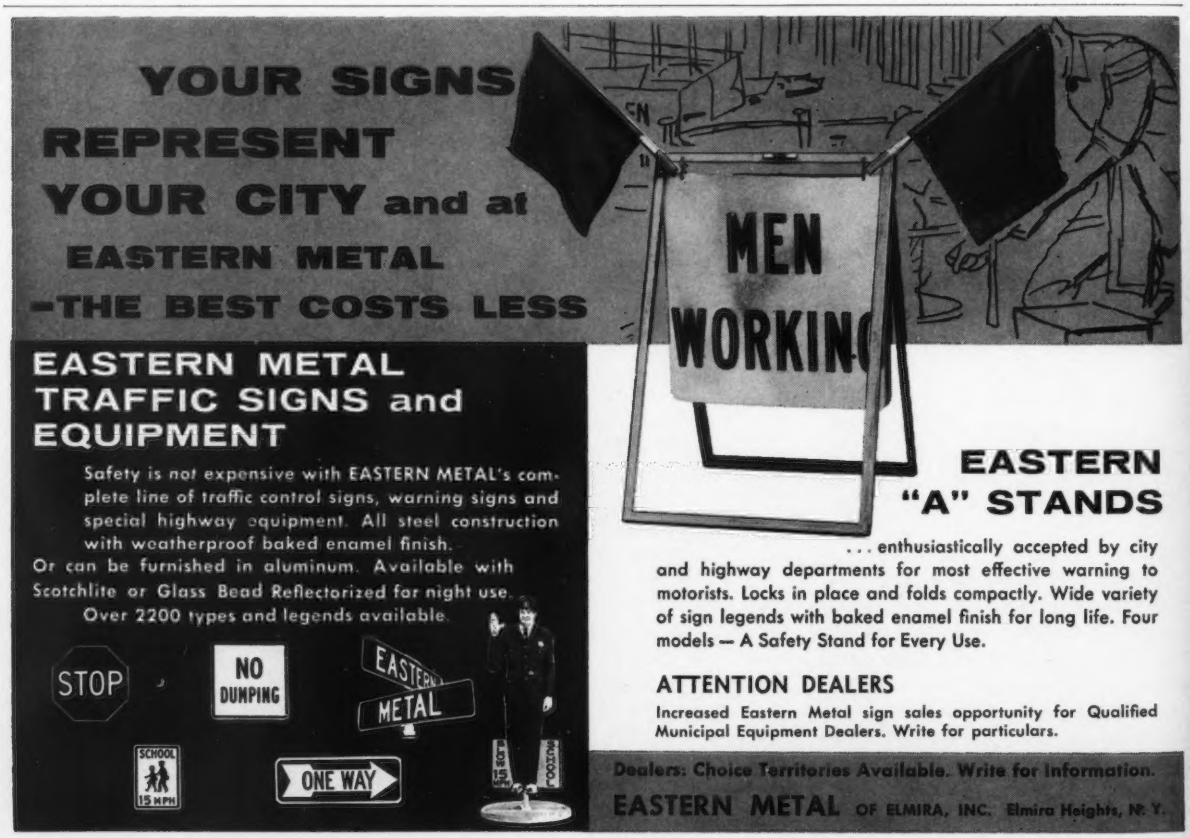
September 12-16 — INSTITUTE OF TRAFFIC ENGINEERS—
30th Annual Meeting, Edgewater Beach Hotel, Chicago, Ill. Contact: ITE, 2029 K St. N.W., Washington 6, D. C.

September 19-22—INTERNATIONAL MUNICIPAL SIGNAL ASSOCIATION—
Annual Meeting, Astor Hotel, New York City. Contact: Irvin Shulsinger, IMSA, 130 West 42nd Street, New York 36, N.Y.

September 26-30—FIFTH INTERNATIONAL TRAFFIC STUDY WEEK—
Nice, France. Contact: M. H. Perlowski, Secretary to the OTA/PIARC/IRF Joint Committee, 32 Chesham Place, London S.W.1, England.

October 9-12—AMERICAN TRANSIT ASSOCIATION—
Annual Meeting, Sheraton Hotel, Philadelphia, Penna. Contact: ATA, 355 Lexington Ave., New York, N. Y.

October 9-13—AMERICAN SOCIETY OF CIVIL ENGINEERS—
Annual Convention, Statler Hotel, Boston, Mass. Contact: ASCE, 29 West 39th St., New York, N. Y.


YOUR SIGNS REPRESENT YOUR CITY and at EASTERN METAL -THE BEST COSTS LESS
MEN WORKING
EASTERN METAL TRAFFIC SIGNS and EQUIPMENT
Safety is not expensive with EASTERN METAL's complete line of traffic control signs, warning signs and special highway equipment. All steel construction with weatherproof baked enamel finish.
Or can be furnished in aluminum. Available with Scotchlite or Glass Bead Reflectorized for night use.
Over 2200 types and legends available.
STOP
NO DUMPING
EASTERN METAL
SCHOOL 15 MPH
ONE WAY
EASTERN "A" STANDS
. . . enthusiastically accepted by city and highway departments for most effective warning to motorists. Locks in place and folds compactly. Wide variety of sign legends with baked enamel finish for long life. Four models — A Safety Stand for Every Use.
ATTENTION DEALERS
Increased Eastern Metal sign sales opportunity for Qualified Municipal Equipment Dealers. Write for particulars.
Dealers: Choice Territories Available. Write for Information.
EASTERN METAL OF ELMIRA, INC. Elmira Heights, N. Y.

NEW

EAGLE

KB170-KB380 SERIES

traffic signals

OFFER MAXIMUM FLEXIBILITY . . .

Through EAGLE'S NEW section DESIGN

Eagle's New KB170 Series (8" signals) and KB380 Series (12" signals) signal sections are perfectly matched in appearance and may be freely interchanged in assembly. Complete signals have clean, modern appearance with all sections in line, whether made up of all 8" sections, all 12" sections, or a combination of 8 and 12 inch sections.

QUALITY FEATURES THAT ASSURE A BETTER SIGNAL

- **Matched Section Design for 8" and 12" Signals**
- **All Sections Die Cast Aluminum with Integral Closed Ends — 8" and 12" Signals**
- **Neoprene Gaskets Throughout**
- **Silvered Glass or Alzak Reflectors**
- **Anti-Sun Phantom Optical Unit**

Whose Fault Is It?

The following article appeared in "The UNESCO Courier," published by The United Nations Educational, Scientific and Cultural Organization:

"Road travel is the most dangerous form of transportation in Europe today. This is clear from a report of the Economic Commission for Europe dealing with the prevention of road accidents, which suggests that even greater casualty figures can be expected unless prompt action is taken.

"The report reviews the main causes of fatal accidents and injuries on the roads and gives a breakdown of the factors responsible. It reveals the striking fact that the risk of death on the roads of Europe for a given distance is ten times that, involved in travel either by aircraft or train.

"Figures quoted for every 100 millions of kilometres traveled by road vehicles were: 18 people killed in Western Europe, 10 people in Great Britain and less than five in the U.S.A.

"What are the causes of these road accidents? Are faulty vehicles the chief culprits? . . . or faulty roads? . . . faults in the traffic control? . . . or just plain, faulty human beings? There are many contradictions and discrepancies in the reasons given. Figures from one country incriminate the bad state of highway surfaces; those from another blame faulty automobile brakes. One reason for this is that different reports may record different opinions as to the cause of similar types of accidents.

"This is often true of a typical accident—the collision of two vehicles at a cross-roads where visibility is poor. The driver coming from the left (the example here applies in France, where drivers coming from the right have priority) would in all likelihood be blamed by the police for entering the cross-roads at an excessive speed.

"A traffic specialist might object that the speed in question (say 20 m.p.h) was not excessive in view of the fact that the automobile was designed to travel at speeds between 30 and 55 m.p.h., in normal conditions. The accident, he would say, was due to the limited visibility at the cross-roads. Suitable for the age of ox or horse-drawn transport, the cross-roads is quite inadequate for the modern vehicles now using it. His conclusion would be that the state was to blame for not making the necessary changes. Which view is correct? In reality the views expressed in both cases are subjective ones.

"It is, however, possible to get an idea of the share borne in accidents by faulty roads. German studies of the country's auto route system, for example, have led to the conclusion that road improvements could halve accidents on these highways.

"Faulty vehicles are on the average only alloted a low percentage (5%) of responsibility for accidents.

"What about the faulty human being? In Italy, the 'Ispettorato della Motorizzazione Civile' examined 2,000 road accident cases in which there were almost always fatal results. The study showed that accidents due to human error amounted to over 52%; to faulty vehicles, 7% and to faulty roads, 40%.

"The point has been made, regarding the comparison between auto route accident rates and those on ordinary roads in Europe that the large number of accidents involving cyclists and pedestrians on these roads is due to the very fact that they are allowed to carry traffic of such a mixed nature. In other words the fault is not with the pedestrian or the cyclist as much as the inadequacy of the road itself.

"It has been estimated that proper road development would bring down the (roughly) 30% of accidents attributed to cyclists and walkers to as low as 5%.

"In round figures, accident responsibility on the roads of Europe could be defined, on the basis of available figures, as follows: faults of motor vehicle drivers, 20%; faults of cyclists and pedestrians, 5%; faulty vehicles, 5%; faulty roads, 70%.

Rubberized Asphalt Shows Advantages

A better national highway system at lower ultimate cost is possible through use of rubber additives in asphalt paving materials.

This was pointed out by research chemists of the Goodyear Tire & Rubber Company at a Symposium on "rubber in asphalt." The meeting was conducted by the Asphalt Institute, a world-wide organization of more than 50 asphalt producing companies.

In presenting a paper prepared by Goodyear research men, E. A. Sinclair said the value of rubber in asphalt is proved by the more than 2,000 miles of rubberized asphalt roads now in use throughout the United States. Goodyear's role in developing an economical rubber paving additive was covered in the paper prepared by H. A. Endres, manager of rubber and plastics products research, and research chemists K. E. Bristol and Sinclair.

"Roads built with rubberized asphalt have greater resistance to impact, shock and weather extremes," Sinclair stated. "Such roads are capable of carrying the large volumes of high speed traffic contemplated for an expanded highway system of the future."

Actual road tests, he pointed out, have proved the benefits of adding rubber to asphalt for both hot mix asphaltic concrete and seal coat construction.

"Physical properties of asphalt paving materials are greatly improved by rubber," Sinclair said. "This results in greater elasticity, ability to withstand fluctuating weather conditions and longer wearing road surfaces.

"Another advantage is the ability of rubberized asphalt to stick to and hold many types of paving stone. Some of these cannot be held satisfactorily by

FOR THE NEWEST BEST Most Accurate Aid To VEHICLE COUNTING

try Muni Quip's TRAFFIC COUNTER

- Counts cars, no chatter; accurate, counts every time.
- Counts cars immediately—No adjustment needed.
- Resets manually to zero.
- Counts 100,000 cars by direct reading.
- 12-volt operation—Uses two 6-volt batteries
- Comes in a tamper-proof box.
- Equipped with 60 feet of road tube.

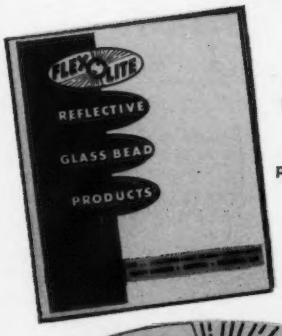
OTHER PRODUCTS
- Radar Timer
- Portable Traffic Signals
- Portable School Flashers
- Traffic Counter
- Traffic Timer

FOR MORE INFORMATION PHONE OR WRITE

MUNI QUIP CORP.

989 WEST KING STREET DECATUR, ILLINOIS

Reflectorize with *Lead-Free* No. 831 (High Index) and UB 68 (Medium Index) Sign Kits



Write today for free booklet. Contains test and specification data, application procedures, and other helpful information.

If you're in a sign budget dilemma, you'll solve your problem more readily with optical quality No. 831 and UB 68 Reflective Glass Beads. No. 831, best for white and yellow signs, and UB 68, for application in the darker pigmented colors, are *lead-free* . . . won't turn dark, provide extra reflectivity throughout a longer life for greater safety and economy.

Bead budgets go farther . . . the result of better research and engineering and advanced methods of manufacture. And with today's overall improvements in quality, gradation, and application techniques, you have the combination that spells better reflectorized signs for less—with *whitest white, lead-free, optical quality* glass beads by Flex-O-Lite. Write for details.

FLEX-O-LITE

FLEX-O-LITE MANUFACTURING CORP.

8301 Flex-O-Lite Drive, St. Louis 23, Missouri
Flex-O-Lite of Canada, Ltd., P. O. Box 216, St. Thomas, Ontario, Canada • Paris, Texas
MAKERS OF DROP-ON • FREE-FLOWING
STANDARD • MILITARY • MOISTURE-PROOF • HIGH AND MEDIUM INDEX SIGN BEADS

regular asphalt. This frequently makes it possible for road contractors to use locally available stone at significant savings.

"In paving jobs all over the country, excellent road surfaces have been produced using low cost pea gravel with rubberized asphalt instead of much more expensive crushed limestone with regular asphalt."

POSITIONS AVAILABLE

(Continued from page 43)

MARYLAND STATE ROADS COMMISSION

Position: Highway Engineer III, Traffic Option. Employees will work under the Director of the Traffic Division of the Maryland State Roads Commission and will encounter in the Baltimore and Washington area all the traffic conditions that might be found throughout the United States.

Requirements: Bachelor's degree in engineering, six years experience in highway, bridge or general civil engineering including specialized traffic engineering experience. High school graduates with satisfactory traffic engineering experience may be considered.

Salary: $7800-9750 (Maximum in six years). Fringe benefits. Maryland Merit System.

Apply: Immediately to the Commissioner of Personnel, 301 W. Preston Street, Baltimore 1, Maryland—VErnon 7-9000.

"He's not only driving without a safety inspection sticker, but the guy's also a Litterbug."

YEARBOOK CHANGES

BRANIGAN, Daniel A. (Member)
527 Paseo De Los Reyes, Redondo Beach, California.

BRAUNIG, Carl F., Jr. (Associate)
Senior Traffic Engineer, Texas Highway Department, Beacon Hill Station, General Delivery, San Antonio 1, Texas. PErshing 5-8094. SEND MAIL: 323 Linda Drive, San Antonio 12, Texas.

BUCKLEY, J. Paul (Member)
Chief Engineer, Highway Division, Automotive Safety Foundation, 200 Ring Building, Washington 6, D. C. FEderal 8-3115.

CROSBY, John R. (Associate)
Senior Traffic Engineer, M. M. Dillon & Co., Ltd., 88-90 Eglinton Avenue, E., Box 217 Sta. K, Toronto 12, Ontario, Canada. HUdson 1-6886.

FRITTS, Carl E. (Member)
Vice President i/c Engineering, Automotive Safety Foundation, 200 Ring Building, Washington 6, D. C. FEderal 8-3115.

GIBBONS, John W. (Affiliate)
Director, Public Relations, Automotive Safety Foundation, 200 Ring Building, Washington 6, D. C. FEderal 8-3115.

GRUNOW, Robert N. (Member)
Highway Engineer, Highways Division, Automotive Safety Foundation, 200 Ring Building, Washington 6, D. C. FEderal 8-3115. SEND MAIL: 1714 A West Main Steet, Jefferson City, Missouri.

JOHNSON, Pyke (Affiliate)
Consultant, Automotive Safety Foundation, 200 Ring Building, Washington 6, D. C. FEderal 8-3115.

KARNIG, Barkev (Associate)
Traffic Devices Engineer, Ontario Department of Highways, 559 Jarvis Street, Toronto, Ontario, Canada. SEND MAIL: 235 Hanna Road, Toronto 17, Ontario, Canada.

KASK, Mart (Junior)
Associate Traffic Engineer, Department of Public Works, City Hall, Richmond, California. BEacon 2-1212, ext. 407.

MATTSON, J. O. (Affiliate)
President, Automotive Safety Foundation, 200 Ring Building, Washington 6, D. C. FEderal 8-3115.

MAY, John F. (Junior)
Civil Engineer III, Illinois Division of Highways, 6035 No. Mt. Hawley Road, Peoria, Illinois, 2-5431. SEND MAIL: 1017 N. Glenwood Street, Peoria, Illinois.

McCORMACK, C. F. (Member)
Deputy Chief Engineer, Highways Division, Automotive Safety Foundation, 200 Ring Building, Washington 6, D. C. FEderal 8-3115.

MENGILIBORU, Sedat (Member)
Deputy Department Head of Construction and Maintenance (Traffic), General Directorate of Highways, Ankara, Turkey. SEND MAIL: P. K. 193, Yenisehir, Ankara, Turkey.

MICKLE, D. Grant (Member)
Director, Traffic Engineering Division, Automotive Safety Foundation, 200 Ring Building, Washington 6, D. C. FEderal 8-3115.

OWENS, Terry J. (Member)
Urban Highway Engineer, Automotive Safety Foundation, 200 Ring Building, Washington 6, D. C. FEderal 8-3115.

ROBINSON, Carlton C. (Associate)
Traffic Engineer, Automotive Safety Foundation, 200 Ring Building, Washington 6, D. C. FEderal 8-3115.

SADAI, Yoshiaki (Associate)
Section Chief of Road Planning Section, Shikoku Regional Construction Bureau, Japanese Ministry of Construction. SEND MAIL: Shikoku-kensetsu-kyoku, Matsushima-cho, Takamatsu-shi, Kagawa-ken, Japan.

SCHOPPERT, David W. (Associate)
Highway Transport Engineer, Automotive Safety Foundation, 200 Ring Building, Washington 6, D. C. FEderal 8-3115.

SCOTT, Clyde W. (Junor)
Sr. Assistant Traffic Engineer, Division of Taffic Engineering & Parking, 1404 E. 9th Street, Cleveland 14, Ohio. TOwer 1-4600, ext. 507.

VOORHEES, Alan M. (Member)
Traffic Planning Engineer, Traffic Engineering Division, Automotive Safety Foundation, 200 Ring Building, Washington 6, D. C. FEderal 8-3115.

MEMBERSHIP APPLICATIONS

The Institute of Traffic Engineers welcomes applications from qualified traffic engineers, but does not desire as members persons who are unqualified. Listed below are the names of those from whom applications for membership or transfer in grade have been received since the last published list. Institute members are urged to review this as soon as possible and immediately inform the Executive Secretary's office if names of people are found who are known to be unqualified for ITE membership or transfer.

New Applications

AHLBERG, Rolf Gosta Ludvig Tufve
Civil Engineer & Traffic Engineer—Orrje & Co. AB, Traffic Department; Jahobsbergsgatan 25 A, Stockholm, Sweden—for ASSOCIATE.

ALEXANDER, Charles Eugene
Assistant Traffic Engineer—City, City Hall, Montgomery, Alabama—for JUNIOR.

BLAIR, Frank Herbert
Highway Superintendent—California State Department of Public Works, Division of Highways, 295 San Bruno Avenue, San Francisco, California—for ASSOCIATE.

FERREIRA do NASCIMENTO, Alberto Dias
Engineer—Junta Autonoma de Estradas (Portuguese Division of Highways), Praca do Comercio, Ala Oriental, Lisbon, Portugal—for ASSOCIATE.

GORDON, Charles E.
Supervisor, Traffic Research Section—Automobile Club of Michigan, 139 Bagley, Detroit 26, Michigan—for ASSOCIATE.

HUSK, Clyde Richard
Traffic Planning & Design Engineer—Metropolitan Dade County Traffic & Transportation Department, 850 N.W. 23rd Street, Miami, Florida—for ASSOCIATE.

ISAAC, Walter Mark
Planning Engineer—Pierce County Road Department, 1033 County-City Building, Tacoma, Washington—for JUNIOR.

KANEKO, Edwin T.
Graduate Student (Highway Transportation)—Civil Engineering Department, Olds Hall, Michigan State University, East Lansing, Michigan—for JUNIOR.

ORNE, Donald Edward
Assistant District Traffic Engineer—Michigan State Highway Department, 1900 Clinton Road, Jackson, Mchigan—for JUNIOR.

PEGRUM, Brian Valentine
Engineer in charge of Investigations & Research Section—Main Roads Department, Malcolm Street, Perth, Western Australia—for ASSOCIATE.

REED, Marshall Foster, Jr.
Senior Highway Planning Engineer—Penn-Jersey Transportation Study, 51st & Parkside, Philadelphia 31, Pennsylvania—for JUNIOR.

du RIETZ, Ulf B:son
Traffic Engineer—Orrje & Co. AB, Jakobsbergsgatan 25 A, Stockholm, Sweden—for JUNIOR.

ROBINSON, Michael
City Traffic Engineer—Bureau of Street Traffic, Room 709, City Hall, Chicago 2, Illinois—for MEMBER.

SCHMITT, William, Jr.
Planning & Programming Engineer, New Jersey Division Office—U.S. Bureau of Public Roads, 1305 Parkside Avenue, Trenton, New Jersey—for ASSOCIATE.

SHEELY, Henry Daniel
Director of Traffic Control—City, Municipal Building, Danville, Virginia—for ASSOCIATE.

SHELLMER, Richard A.
Traffic Engineer—Parsons, Brinckerhoff, Quade & Douglas, 165 Broadway, New York 6, New York—for ASSOCIATE.

SUNDE, Glenn R.
Village Engineer and Village Traffic Engineer—Euclid and Lake Street, Village of Oak Park, Illinois—for ASSOCIATE.

WOEHRLE, Albert Hans, Jr.
Traffic Engineering Analyst—Penn-Jersey Transportation Study, 51st & Parkside Street, Philadelphia 31, Pennsylvania—for JUNIOR.

Applications for Transfer

AVERY, Eugene V.
Chief Engineer, Department of Public Works—City of St. Paul, 234 City Hall, St. Paul 2, Minnesota—for MEMBER.

DOUGHTY, James Robert
Supervising Traffic Control Engineer—City, 417 Lincoln Park Drive, Cincinnati 3, Ohio—for ASSOCIATE.

LEIS, Leonard Emil
Director of Public Service—City, 525 N. Erie Street, Toledo 2, Ohio—for ASSOCIATE.

MAY, Adolf D., Jr.
Member Technical Staff—Thompson-Ramo-Wooldridge, 8433 Fallbrook Avenue, Canoga Park, California—for ASSOCIATE.

RHUDY, Harold Clingman
Area Traffic Engineer—North Carolina State Highway Commission, Traffic Engineering Department, Raleigh, N. C.—for MEMBER.

SPITZ, Salem
Taffic Engineer—City, Room 1207 City Hall, Los Angeles, California—for ASSOCIATE.

THE TRAFICOUNTER, JR.

is a simple, sturdy, time-tested device for traffic counting. It is pneumatically actuated by means of the road tube attachment.

Traffic volume is easily read on direct reading counter. Can be rapidly installed anywhere. Rugged construction; will last for years.

Write for illustrated Bulletin.

TORONTO, ONTARIO E. A. HORTON SALES CO., 3071 BLOOR ST. WEST

THE STANDARD OF ACCURACY SINCE 1888

STREETER-AMET COMPANY

GRAYSLAKE • ILLINOIS

Branches in Detroit, Pittsburgh, Allentown, Birmingham and Los Angeles

Institute of Traffic Engineers

SUSTAINING ORGANIZATIONS 1960

The following organizations have contributed to the Technical Research and Development Fund for 1960 and are classified as Sustaining Organizations:

Aluminum Company of America
1501 Alcoa Building Pittsburgh 19, Pa.
R. G. St. John, Representative

American Transit Association
355 Lexington Ave. New York 17, N. Y.
George W. Anderson, Representative

Automatic Signal Division Eastern Industries, Inc.
Regent Street East Norwalk, Conn.
Paul L. Green, Representative

J. E. Bauer Company
1021 N. Mission Road, Los Angeles 33, Calif.
Roy Meggison, Representative

California Metal Enameling Company
6904 East Slauson Ave. Los Angeles 22, Calif.
Hugh V. Penton, Representative

Cataphote Corporation
2505 Albion St. Toledo 10, Ohio
J. E. Fagala (P.O. Box 2066, Jackson, Miss.) Representative

The Clinton Company
1210 North Elston Ave. Chicago 22, Ill.
Richard H. Clinton, Representative

Crouse-Hinds Company
Wolf & Seventh North Streets, Syracuse 1, N. Y.
K. C. Eichelberg, Representative

Duncan Parking Meter Division of Motor Products Corporation
835 North Wood Street Chicago 22, Illinois
R. J. Smott, Representative

Eagle Signal Company
Moline Illinois
W. H. Peterson, Representative

Econolite Corporation
8900 Bellanca Ave. Los Angeles 45, Calif.
Aubrey Matthews, Representative

Federal Sign and Signal Corporation
13601 S. Western Avenue Blue Island, Ill.
R. D. Weisener, Representative

Flex-O-Lite Manufacturing Company
P.O. Box 3066 (Affton Br.) St. Louis 23, Mo.
Charles R. Dernbach, Representative

General Electric Company
Outdoor Lighting Dept. Hendersonville, N. C.
W. E. Schwanhausser, Representative

General Railway Signal Company Electronic Control Division
105 Hague Street Rochester 11, N. Y.
Jerome O'Neill, Representative

Interstate Rubber Products Corporation
908 Avila Street Los Angeles 12, Calif.
Clarence R. Fitzsimons, (Western Marketing Service, 149 Highwood Ave., Weehawken, N.J.) Representative

Kar-Trol Signal Company, Inc.
12739 South Main Houston 35, Texas
Jack Hulett, Representative

Magee-Hale Park-O-Meter Company
P.O. Box 7247 Oklahoma City 12, Okla.
G. A. Hale, Representative

The Marbelite Company, Inc.
179 N. 10th St. Brooklyn 11, N. Y.
William E. Lenz, Representative

Minnesota Mining and Mfg. Co.
900 Bush Avenue St. Paul 6, Minnesota
Donald O. Opstad, Representative

Motorola Communications and Electronics, Inc.
4501 West Augusta Blvd., Chicago 51, Illinois
Stanley H. Burg, Representative

Outdoor Advertising Association of America, Inc.
24 W. Erie St. Chicago 10, Illinois
Don Martin, Representative

Pfaff and Kendall
84 Foundry Street Newark 5, New Jersey
George C. Masefield, Representative

Prismo Safety Corporation
Huntingdon Pennsylvania
John C. Horn, Representative

Robbins Tire and Rubber Company
Tuscumbia Alabama
Ellis Webb, Representative

Rockwell Manufacturing Company—Dual Parking Meter
400 N. Lexington Avenue Pittsburgh 8, Pa.
J. L. McCullough, Representative

Stimsonite Signal Devices Elizabeth Division of ESNA
1027 Newark Ave. Elizabeth 3, N. J.
John F. Brady, Representative

Streeter-Amet Company
Grayslake Illinois
George F. Graham, Representative

Traffic Signals, Inc.
222 Beach Street Shreveport, Louisiana
J. Frank Williamson, Jr., Representative

The Union Metal Manufacturing Company
1432 Maple Avenue, N.E. Canton 5, Ohio
K. C. Dorland, Representative

Veon Chemical Corporation
22-09 Bridge Plaza N., Long Island City 1, N. Y.
Norman Lipkins, Representative

Winko-Matic Signal Co.
P.O. Box 389 Lorain, Ohio
Irwin Hart, Representative

Section News

MIDWEST SECTION

Richard J. Hocking, member of Northwestern University ITE Student Chapter, shown receiving award for best student paper on traffic engineering in annual competition sponsored by Midwest Section. Past-president advisor William R. Marston made the presentation.

METROPOLITAN—MID-ATLANTIC SECTIONS

A very successful joint meeting of the Metropolitan Section and the Philadelphia region of the Mid-Atlantic Section was held in Trenton on April 21. The subject was the Penn-Jersey Transportation Study, discussed by Michael Gittens and Jack Mowll. This was an interesting meeting. Dave Baldwin, from ITE headquarters, was a welcome guest.

WASHINGTON (D.C.) SECTION

A seminar on electronics in traffic engineering was held on April 21. Topics discussed included electronic traffic control in cities; traffic control on freeways; environmental simulation; traffic flow theory; automotive control; data processing and communication. Chaired by O. K. Normann, Deputy Assistant Commissioner for Research, Bureau of Public Roads, this seminar was attended by approximately 80 persons including one from California and one from New York.

CANADIAN SECTION

A course on traffic engineering given by Walter Macnee and Phil Wade had 99 registrants. This large number signifies the interest in traffic engineering in the Toronto area.

Formation of Canadian Section Policy Committee

A very important step was taken recently when Bill Finnbogason, President, appointed a Canadian Section Policy Committee. The Committee will be chaired by Jacques Barriére, and the other members will include the Executive and Messrs. R. Burton, K. Vaughan-Birch, E. Wiley and H. F. Burns. The non-executive members will serve until the fall of 1961 so as to provide for continuity in its operation.

The need for such a committee has been expressed by the President in the following words, "If we, as an organization, are to attain national recognition and to maintain our rightful position in the transportation field in this country, we must develop very clear-cut policies on which to build a continuing and effective organization."

Among the first tasks of the committee is the submission of a report concerning the

establishment of technical committees and a list of projects to be undertaken. The committee will also consider resolutions that the Canadian Section should submit to the 1960 Annual Meeting in Chicago.

TEXAS SECTION

A summer meeting for TexITE members, families and friends is planned for June 18 at the Sands Hotel in Abilene. Joe Wright is in charge of the technical program, Chuck Clinard is General Chairman and Bud Taylor is Committee Chairman.

The 34th Annual Highway Short Course was held at the Memorial Student Center on the A & M campus March 8-10 with over 1,000 persons representing the various districts and divisions of the Texas Highway Department, various city engineering staffs, and various manufacturers and distributors of highway equipment in attendance.

Charles J. Keese, Charles Pinnell and William R. McCasland were recipients of the Highway Research Board merit award for the outstanding paper presented at its 1959 Annual Meeting. The paper, a report on research conducted at the Texas Transportation Institute in cooperation with the Texas Highway Department, was entitled "A Study of Freeway Traffic Operations."

The second annual transportation conference was held on March 31 on the A & M campus. The one-day affair attracted many officials of the highway, railroad, trucking and pipe line industries.

FLORIDA SECTION

Formal approval of the formation of this Section was given on May 10.

Arrangements are well underway for a short course in traffic engineering to be held at the University of Florida October 3-5. Co-sponsored by the Florida Section and the General Extension Division of Florida, this course will include panel discussions and lectures by traffic engineers who are expert in their fields.

Promotion of traffic engineering throughout the state will be given a substantial boost with completion of the state-wide roster of speakers which is presently being compiled by the Section. The Public Relations Committee is putting the finishing touches to a list of traffic engineering speakers throughout the state based on questionnaires sent to all ITE members in Florida. This list, which also covers special topics, will be made available to all groups wishing to schedule a traffic engineering talk.

WESTERN SECTION

Plans for the 13th Annual Meeting of the Section are moving along rapidly under the direction of a group of Bay ITEers.

The first completed phase of the Salt Lake Transportation Study—street use classification—was submitted to the Co-ordinating Committee. Agreement on land use, inventory procedures and techniques has also been achieved.

The 3rd Annual Highway Engineering Conference, held at the College of Pacific in Stockton early in March, was a great success. Bruno Dentino and Doug Carmody were among the participants.

A panel discussion on the Seattle-King County Transportation Study drew a record crowd of 70 to the Washington Area March meeting.

The Oregon area reports that the Northwest Highway Engineering Conference held in Corvallis March 23-25 was well attended and well received.

Summer...
now is the time to properly light your construction hazards
USE THE
DIETZ
3
WAY
HAZARD WARNING
SYSTEM
It's Summer... more highway projects... more traffic, too!
Whatever the season, wherever the road... it's always the right time to adequately light your highway hazards. Protect the public and you protect yourself.
NEW! DIETZ
HAZARD WARNING
PLANNER
A Practical On-the-Job Tool! Quickly and easily shows how, when, and where to use each type of warning light for maximum safety under all weather conditions and all types of roads and speeds.
Send $1.
for each Planner — personalized with your name
LANTERNS
TORCHES
VISI-FLASH
Use Dietz Visi-Flash Lights to alert the oncoming driver. Brightest, safest, most trouble-free flashers on the market. Warn: "Danger Ahead" for up to 1500 hours without changing batteries.
Use Dietz Lanterns to locate hazard in relation to driver's position. Show exact location, shape, extent, and boundaries of hazard area. Burn up to 100 hours.
Use Dietz Torches to guide driver around the hazard. Fully illuminate the danger in every weather. Burn up to 48 hours on low cost kerosene.
R. E. DIETZ COMPANY
Dept. 126, 225 Wilkinson St., Syracuse 1, N.Y.
Go DIETZ
and you go Safely

Professional Service Directory

DE LEUW, CATHER & COMPANY
CONSULTING ENGINEERS

Public Transit — Subways
Traffic & Parking — Railroad Facilities
Expressways — Industrial Plants
Grade Separations — Municipal Works
Urban Renewal — Port Development

150 North Wacker Drive, Chicago 6
San Francisco — Toronto — Boston

Traffic - Parking - Highways - Transit - Design Consulting - Financing Aids
City Planning - Urban Redevelopment

E. A. BARTON and ASSOCIATES
• *Consultants* •
Cleveland Transit Building • Cherry 1-0600 • Cleveland 14, Ohio
New York City • Toronto • St. Louis

TRAFFIC
TRANSPORTATION — PARKING
THE CLARKESON ENGINEERING COMPANY INCORPORATED
285 Columbus Ave., Boston 16, Mass.
COmmonwealth 6-7720
HIGHWAYS — AIRPORTS

EDWARDS AND KELCEY
ENGINEERS AND CONSULTANTS
Highways — Structures — Airports
Traffic — Parking — Soils
Ports — Parks — Sewerage
3 William Street, Newark 2, New Jersey
Boston — New York
Salt Lake City — Minneapolis

RAMP CONSULTING SERVICES, INC.
Parking & Traffic Surveys — Design Services
Parking Programs — Feasibility Studies
2 West 46th Street, New York 36, N. Y.
Formerly Consulting Service Division
Ramp Buildings Corporation

Hawkins Traffic SAFETI-BAR

NEW EPOXY ADHESIVE WORKS MIRACLES

Concepts evolving from use of jiggle-bars are often misunderstood. Barriers, damaging obstacles and pre-cast curbs which throw vehicles out of control have no engineering factors. A true jiggle-bar CONTROLS, GUIDES. PROTECTS and is a step TOWARD SAFETY.
PROTECTING a TRAFFIC SIGN with DEATH is not an Engineering feat.
Write for Illustrated Circular

MANY USES:—"Safeti-Bars" are your "best bet" for protecting safety islands, preventing dangerous left turns, centerlining narrow bridges and tunnels, marking and channelizing parking lots, etc.

EASILY INSTALLED:—No pins required with Epoxy Adhesive. Removeable type mastic and pins also available for temporary installations. Bars are enameled Aluminum; available with reflective coating optional.

HAWKINS - HAWKINS CO., INC.
Traffic Safety Devices
1255 EASTSHORE HIGHWAY — BERKELEY 10, CALIFORNIA

INDEX TO ADVERTISERS

Automatic Signal Division of Eastern Industries	10
B & G, Incorporated	39
California Metal Enameling Company	34
Cataphote Corporation	8
R. E. Dietz Company	57
Duncan Parking Meter	3
Eagle Signal Company	51
Eastern Metal of Elmira, Inc.	50
Elastic Stop Nut Corporation (Stimsonite)	45
Flex-O-Lite Manufacturing Corporation	53
Hawkins-Hawkins Company, Inc.	58
Kerrigan Iron Works, Inc.	2
Marbelite Company, Inc.	27
Minnesota Mining & Manufacturing Company	6
Muni-Quip Corporation	52
Prismo Safety Corporation	Back Cover
Radiator Specialty Company	33
M. H. Rhodes, Inc.	4
Rockwell Manufacturing Company (Dual)	30 & 31
Streeter-Amet Company	55
Time-O-Matic, Inc.	36
Traffic Signals, Inc.	47
Traffic & Street Sign Company	42
Union Metal Manufacturing Company	7

Professional Service Directory

TRAFFIC ENGINEERING — HIGHWAY PLANNING

BRUCE CAMPBELL & ASSOCIATES
ENGINEERS

177 MILK STREET • BOSTON 9

PARKING — AIRPORTS — SHOPPING CENTERS

PARSONS, BRINCKERHOFF QUADE & DOUGLAS

Engineers

Bridges, Highways, Tunnels, Airports, Subways, Harbor Works, Dams, Canals, Traffic, Parking and Transportation Reports, Power, Industrial Buildings, Housing, Sewerage and Water Supply.

165 Broadway — New York 6, N. Y.

CRAWFORD, MURPHY & TILLY
CONSULTING ENGINEERS

Water Works - Impounding Reservoirs
Highway - Municipal Streets - Expressways
Traffic Problems - Airports
Swimming Pools
Sewers - Sewage Treatment
Waste Treatment - Storm Drainage
Flood Control - Surveys and Reports

755 So. Grand Ave., W.; Springfield, Ill.
Lakeside 8-5619

HOWARD, NEEDLES TAMMEN & BERGENDOFF

Consulting Engineers

Traffic Analyses — Transportation Studies

EXPRESS HIGHWAY PLANNING
REPORTS AND DESIGN
ADMINISTRATIVE SERVICES

1805 Grand Avenue
Kansas City 8, Missouri
New York — Cleveland

HARDESTY & HANOVER
CONSULTING ENGINEERS

BRIDGES—Long Spans of All Types
Movable—Lift, Bascule & Swing
Hanover Skew Bascule
Grade Crossing Eliminations
Other Structures — Foundations
Expressways and Thruways
Design—Supervision—Inspection
Valuation—Reports

101 Park Avenue — New York 17, N. Y.

PALMER AND BAKER ENGINEERS, INC.
CONSULTING ENGINEERS — ARCHITECTS

Surveys — Reports — Design — Supervision — Consultation

Transportation and Traffic Problems — Tunnels — Bridges — Highways — Airports
Industrial Buildings — Waterfront and Harbor Structures
Graving and Floating Dry Docks
Complete Soils, Materials and Chemical Laboratories

Mobile, Ala. — New Orleans, La. — Washington, D.C.

S. Herbert Taylor — Frank J. Sleeper
David L. Taylor — William H. Taylor

SHERMAN, TAYLOR & SLEEPER
CONSULTING ENGINEERS

(All phases of Civil Engineering)

501 Cooper Street, Camden 2, N. J.
WOodlawn 6-2552

Park & Norwood Aves., Merchantville 8, N.J.
NOrmandy 3-4848

GANNETT FLEMING CORDDRY and CARPENTER, INC.
---ENGINEERS---

CONSULTING SERVICE FOR TRAFFIC PARKING and TRANSPORTATION PROBLEMS
City Planning — Highways — Bridges — Flood Control
Water Supply — Sewerage — Industrial Waste — Garbage Disposal
Appraisals — Investigations — Management

600 NO. 2nd STREET — HARRISBURG, PA.
Pittsburgh, Pa. — Philadelphia, Pa. — Daytona Beach, Fla. — Medellin, Colombia, S.A.

JENKINS, MERCHANT & NANKIVIL

Consulting Engineers

Municipal Improvements — Gas Systems
Highways & Airports — Water Systems
Power Development — Sewerage Systems
Traffic Surveys — Industrial Plants
Flood Control — Recreational Facilities
Investigations and Reports

801-805 East Miller St. — Springfield, Ill.

GEORGE W. BARTON & ASSOCIATES
CONSULTING ENGINEERS

Parking — Highways
Traffic — Transportation

600 Davis Street
Evanston — Illinois

FREDERICK L. BELL & ASSOCIATES, Inc.
CONSULTING ENGINEERS

Traffic and Parking Surveys
Street and Highway Design

P.O. Box 3001 MSS
Phone 4-2332
Tallahassee — Florida

TIPPETTS — ABBETT McCARTHY — STRATTON

Engineers
Traffic, Parking and Transportation

Surveys, Economic Studies and Financial Reports

Highways, Subways, Bridges, Tunnels—Airports, Ports, Harbors, Power Developments, Water Supply, Sewerage

Planning, Reports, Design, Supervision of Construction

375 Park Avenue — 110 Market St.
New York 22, N.Y. — San Francisco, Cal.

Highways — Transit — Traffic — Parking

WILBUR SMITH & ASSOCIATES

495 Orange Street
New Haven, Connecticut

Columbia S.C. • San Francisco Calif. • Richmond Va.

HIGHWAY TRAFFIC ENGINEERS, INC.

Traffic - Parking - Transportation
Economic Studies - Financial Reports
Traffic Control - Design of Lighting Systems and Communications

361 Boylston Street
Brookline 46, Massachusetts
LOngwood 6-0275

ALFRED KAEHRLE ASSOCIATES
CONSULTING ENGINEERS

Highway Planning — Highway Design
Traffic Engineering Surveys
Parking Studies — Shopping Centers

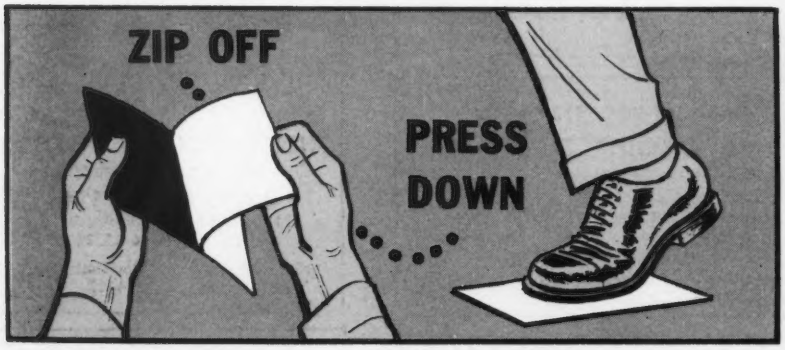
10 North Main Street
West Hartford 7 — Connecticut

PRISMO Presents New

REFLECTORIZED

...New Formula!
...New Adhesive!
...New Whiteness!

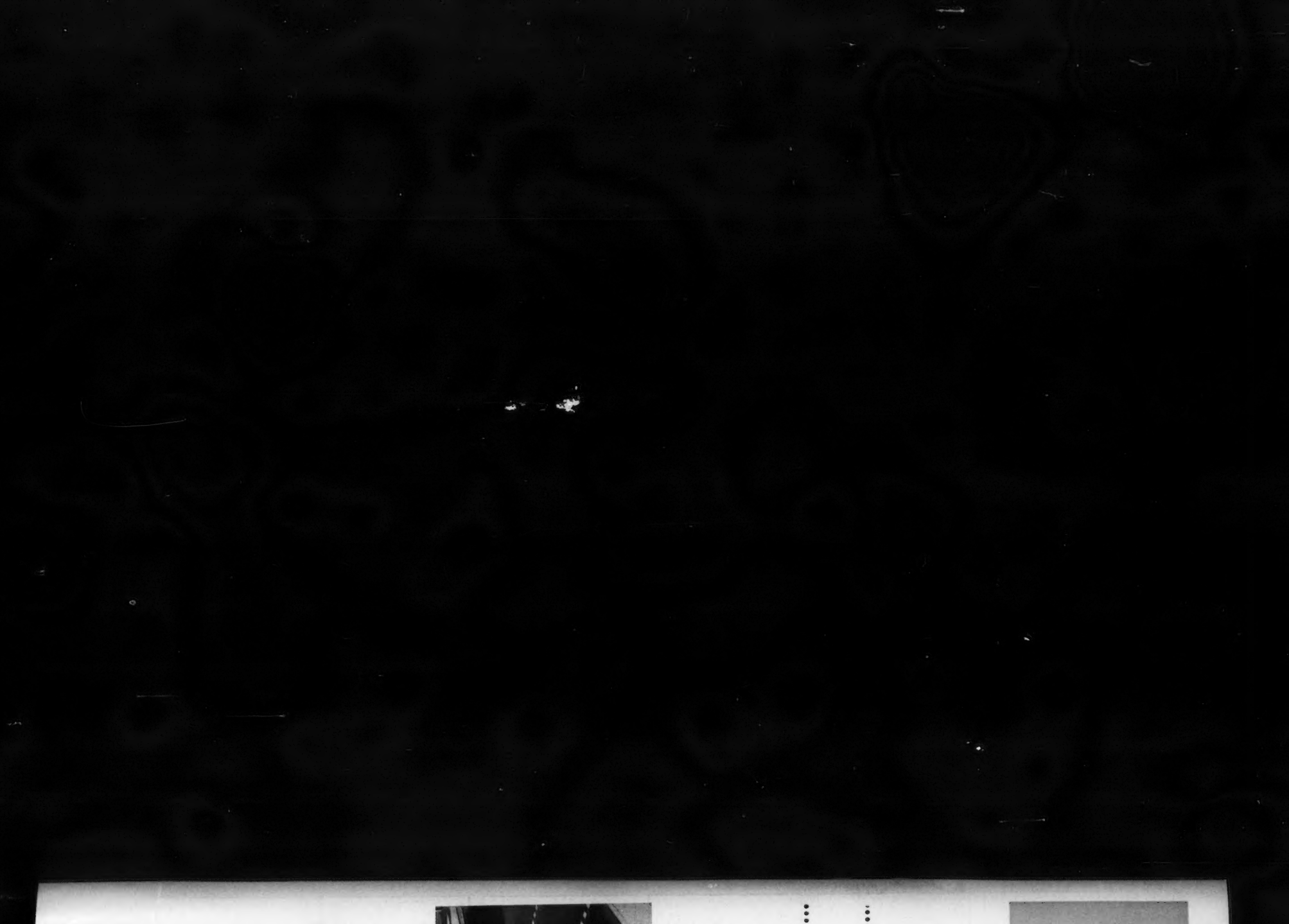
PLASTIX "SD"



No Get-Ready, No Equipment, No Warm-Up Needed!

NEW 1960 CATALOG JUST OUT... *Send for it!*

- Brand new cold flow type Thermo-Plastic with improved tensile strength and non-buckling flexibility.
- Skid-proof, anti-pocking, anti-chip.
- Outlasts paint by as much as 10 to 1, making it the lowest cost per month of use traffic marker you can buy.

Write or phone today for this 16-page, fact-filled catalog that's a must for every traffic engineer or street supervisor. Many diagrams and charts. Ask for bulletin PX60.

PRISMO
SAFETY CORPORATION
HUNTINGDON, PENNA.